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SPECIAL REPORT

RURAL EMERGENCY MEDICAL SERVICES

November 1989

CONGRESS OF THE UNITED STATES
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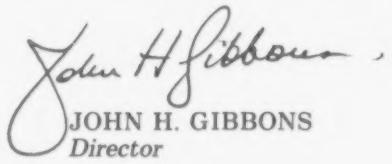
Foreword

The problems of health care in rural areas have long occupied a special niche in policies designed to advance the Nation's health. Programs for recruitment, training, and deployment of health care personnel, for constructing health care facilities, and for financing health care, often have included special provisions for rural areas. These programs have often also included attempts to mitigate the negative impacts on rural areas of policies primarily designed for and responsive to the needs of urban areas. However, some rural areas continue to have high numbers of hospital closures, ongoing problems in recruiting and retaining health personnel, and difficulty in providing medical technologies commonly available in urban areas. Mounting concerns related to rural residents' access to health care prompted the Senate Rural Health Caucus to request that OTA conduct an assessment of these and related issues. The first OTA paper prepared in connection with this assessment, *Defining "Rural" Areas: Impacts on Health Care Policy and Research*, was published in July 1989.

This Special Report, *Rural Emergency Medical Services*, is the second paper prepared in connection with that assessment. This report finds that many State EMS systems are fragmented and lacking resources to remedy EMS problems in rural areas. Many rural EMS programs lack specialized EMS providers, have inadequate EMS transportation and communications equipment, and are not part of a planned regional EMS system. The report describes the availability and distribution of emergency medical service (EMS) resources (e.g., personnel, transportation, facilities) and examines how limited Federal resources can be used to improve rural EMS. In addition, the report discusses how Federal EMS resources might be targeted to States' rural areas.

This report is based, in part, on a May 1989 Rural EMS Workshop that was cosponsored by the Department of Transportation. Valuable guidance was provided by an advisory panel, chaired by Mr. James Bernstein of the North Carolina Department of Human Resources. A number of other experts also provided information and reviewed a draft of the report. The final responsibility for the content of this report rests with OTA. Maria Hewitt was the primary author of this study.



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Chapter 1

Summary and Policy Options

INTRODUCTION

The average U.S. resident will need ambulance service at least twice in his or her lifetime and for some of these patients, delays in receiving emergency care will contribute to death or permanent injury. The one-quarter of Americans who live in rural areas, which occupy four-fifths the country's land area, face special problems in receiving emergency care. It is difficult to deliver emergency medical services (EMS) to widely dispersed populations quickly and in small rural communities, there may be less than one emergency call a day. This relatively low volume of calls may mean that a rural ambulance service cannot support itself financially and that rural EMS providers have difficulty maintaining their specialized skills. The time it takes to reach emergency patients may always be longer in some rural areas than in urban areas because of distances between services and rural residents. Although problems relating to population dispersion are not easily amenable to intervention, many of the problems rural EMS providers are having in delivering EMS care can be alleviated with additional resources and system-wide planning.

Well-organized EMS systems are widely recognized as essential components of medical care. For rural residents for whom no local hospital is available, EMS may be particularly important in helping residents to achieve physical access to health care. Emergency medical services cannot replace basic primary care services, but when medical emergencies occur, a well-organized EMS system can offer rapid medical assistance and transportation to a facility equipped to handle the emergency.

Emergency medical services include the personnel, vehicles, equipment, and facilities used to deliver medical care to those with an unpredicted immediate need outside a hospital and continued care once in an emergency facility (128).[1] EMS *systems* are usually organized at the State or regional level to provide coordinated delivery in an appropriate geographic area (62). The primary goals of an EMS system are to:

- provide immediate medical assistance at the scene and while in transit;
- provide rapid transportation to a medical facility;
- have a coordinated, tiered level of hospital care so that the most seriously injured or ill patients are quickly triaged to specialized facilities for their care, while the less severely injured or ill patients are cared for at less specialized facilities.

Comprehensive EMS systems have been shown to save lives and reduce disabilities (76,128). Among the EMS system components that are required are:

- quick public access,
- on-the-scene emergency care personnel,
- rapid transportation,
- physicians trained to provide EMS care and supervise prehospital care,
- different levels of hospital care for treatment of patients with emergent conditions ranging from "urgent care" to life-threatening trauma, and
- EMS surveillance systems to facilitate system evaluation.

A well-organized EMS system may enhance health care access, but evidence suggests that not all States have developed EMS systems that extend to rural areas. What characterizes EMS systems is their variability. Per capita expenditures for EMS in 1988 ranged from a low of 2 cents in Ohio to nearly $14 in Hawaii (57). As of 1986-87, only two States, Delaware and Maryland, had statewide access to EMS services through a 911 telephone number, while 21 States had only partial 911 EMS access (105). A

[1]Some include rehabilitative care in the definition of an EMS system. While OTA recognizes the importance of the continuum of care required for many EMS patients, rehabilitative care is not specifically discussed in this report.

few States have directed the care of the seriously injured to designated trauma centers, but others do not designate specialized facilities and lack regionalized systems of trauma care. Some States have developed model EMS systems that integrate urban and rural services, while others have isolated, poorly organized rural EMS systems with limited resources.

In the 1980s, EMS services have increasingly become a State responsibility. In 1988, over 80 percent of State EMS funds derived from State or local sources. Federal funding of State EMS activities is limited to support through the Preventive Health and Health Services Block Grant program (administered by the Department of Health and Human Services (DHHS)) and through the Department of Transportation's (DOT) National Highway Traffic Safety Administration (NHTSA). In 1988, $13 million of DHHS's block grant funds were spent by States on EMS, while DOT distributed nearly $5 million for EMS through its State and Community Highway Safety Grant Program (section 402 program) (24,57).

Federal EMS expenditures have declined sharply in the last decade. Following passage of the 1973 EMS Systems Act, about $30 million were spent annually on EMS. In the early 1970s, EMS systems were found to be underequipped, poorly staffed, and fragmented. Many EMS services were provided by funeral homes, and prehospital care providers often lacked basic medical skills. The EMS Systems Act resources were targeted to rural areas because they were more likely to be lacking resources than urban areas.

Funding through the 1973 EMS Systems Act is credited with having provided incentives for regions to plan and upgrade EMS services. Many communities used EMS Act funds to improve their communications systems, train EMS prehospital providers, and regionalize care. However, the goal of the EMS Act—to blanket the country with high-quality EMS programs—was not met before its demise in 1981. In 1981, a number of categorical programs, including EMS, were folded into a block grant program. With the advent of the block grant program, EMS spending declined and has not yet risen to spending levels of the late 1970s (128).

With new evidence that EMS systems are fragmented and lacking resources, several Federal initiatives have been proposed to bolster State EMS systems and target resources to rural areas. How limited Federal resources can be used to improve rural EMS systems is the subject of this report. The report describes the availability and distribution of EMS resources (e.g., personnel, transportation, facilities) and discusses Federal EMS policies that affect these resources, but does not specifically address Federal EMS reimbursement policies. This report is based, in part, on a May 1989 Rural EMS workshop (cosponsored by DOT and OTA) and on background papers prepared for the workshop. (See app. A, list of workshop participants.)

EMS IN A RURAL CONTEXT

The past decade has witnessed major changes in the U.S. health care system, including both how health care is paid for (e.g., implementation of prospective hospital payment in the Medicare program) and how health care is delivered (e.g., a shift to outpatient services). In some rural areas[2] a decline in the economy has accompanied these changes, making it difficult for many rural health care systems that are small and lacking diversification to adjust to the new health care environment. Since 1981, nearly 550 rural hospitals have closed (61). In communities with only a single hospital, hospital closure has meant that local access to hospital-based care is lost and ready access to emergency care is diminished.

[2]While there are numerous ways to define rural areas, this report defines rural areas as those areas not designated as Metropolitan Statistical Areas (MSAs). Definitions of rural areas are reviewed in OTA's staff paper, "Defining 'Rural' Areas: Impact on Health Care Policy and Research," published in July 1989 (50).

Many rural areas have difficulty recruiting and retaining physicians, nurses, and other health care personnel because of the heavy demands of rural practice (e.g., longer hours, no backup) or because the area lacks a hospital or other resources that attract providers. In some areas, personnel shortages have been exacerbated by diminished support from Federal programs such as the National Health Service Corps.

Access to well-trained personnel, essential equipment, and facilities in rural communities that lack a local hospital or physician may sometimes be achieved through cooperation with neighboring communities that have medical resources. If the availability of health care services diminishes in rural areas, EMS providers may have to assume new responsibilities. There may be an increased demand for nonemergency transportation to hospitals and for urgent primary care services (e.g., delivering babies). Rural EMS providers are having difficulty providing EMS services even without these basic problems in the health care system. Some specific problems of rural EMS systems are:

- Many rural areas have sparse and dispersed populations that are far from care. Poor roads, or the absence of roads, can delay EMS transport.
- Public access to EMS is compromised by antiquated communications equipment. Universal access to EMS by telephoning 911 is desirable but lacking in many rural areas. Some rural residents must make long-distance telephone calls to obtain emergency assistance. Some rural areas do not have telephone service.
- Radio "dead spots"[3] and crowded radio frequencies interfere with essential communications between rural ambulance crews and hospital-based physicians.
- There are shortages of prehospital care providers, many of whom are volunteers. Available rural prehospital care providers often have a less advanced level of training than their urban counterparts. Training and continuing education opportunities are not available in many rural areas.
- Rural EMS providers have difficulty maintaining specialized skills because of a relatively low volume of EMS calls. There are few innovative teaching strategies being used to overcome this problem.
- There are few rural physicians trained to provide medical supervision of local EMS operations.
- Rural EMS providers often rely on old ambulances and ambulance equipment. Air medical transportation to rapidly access specialized care is not readily available in some rural communities.
- Rural hospital emergency room physicians and nurses often do not have advanced EMS training. Rural hospitals may not have developed EMS protocols that designate the roles and responsibility for EMS among rural EMS providers. The role of the community or local hospital within regionalized systems of special care, such as trauma systems, has not been well established.
- Rural areas often lack the resources needed to address EMS problems.

Information from three States (New York, Texas, and South Carolina) suggests that in both rural and urban areas emergency medical services are more likely to be required for medical conditions (e.g., heart disease and respiratory distress) than for trauma. Two of the most common types of EMS care, EMS cardiac and trauma care, illustrate the special problems of delivering EMS services in rural areas.

Cardiac Care

Providing cardiac EMS care quickly is essential but difficult in many rural areas. In the case of cardiac arrest, cardiopulmonary resuscitation (CPR) must begin within 4 minutes and definitive care within 10 minutes of the arrest (116). Rural EMS systems are at a disadvantage in

[3]Some rural areas are outside the range of available radio equipment.

treating cardiovascular emergencies, because they often lack paramedic prehospital providers, who are much more successful than basic-level emergency medical technicians (EMTs) in treating cardiac arrest (52). However, some rural communities have improved emergency cardiac care by implementing "bystander" education or "first responder" programs to improve the chances that CPR or first aid will be administered quickly and will continue until the ambulance arrives, and by training EMTs to use automatic external defibrillators. Automatic external defibrillators are particularly well suited to the needs of rural areas because they are easy to use, and because the skills needed to use them do not deteriorate even if the procedure is not performed often (100).

Not all rural communities, however, have the resources or conditions that would permit effective use of defibrillators by EMTs. If communities are small, community members are not trained in CPR techniques, and response times are 10 minutes or more, a community should direct its resources to improving these conditions before instituting an EMT defibrillation program (115). Defibrillators are relatively inexpensive, but training and system-wide supervision of prehospital defibrillation programs may not be. To improve rural EMS cardiac care, bystander and first responder training programs could be implemented; where feasible, EMS response times could be reduced; and physicians, nurses, and EMTs could be trained to supervise and implement EMT-defibrillator programs.

Trauma Care

Injuries[4] occur with nearly equal frequency in urban and rural areas but tend to be more severe in rural areas. Injury-related mortality is higher in rural areas, but basic information is lacking about when, where, and why rural injury and injury-related deaths occur.

Because time to definitive care is such a crucial factor in determining the trauma patient's outcome, higher trauma-related mortality might be expected in rural areas due to delays in detection and response times. In some remote rural areas, delays are unavoidable, but response times may be improved by increasing the number of available ambulances, improving air medical services, or changing the placement of ground or air transport.

Reducing delays to care can also be accomplished by shifting the onset of emergency treatment from the hospital to the prehospital period. Evidence suggests that a "scoop and run" approach is advisable in urban areas, but enhancing the trauma skills of rural EMTs to provide more care during the prehospital phase (without prolonging the time to reach the hospital) might improve trauma outcomes in rural areas. Rural basic-level EMTs could be trained in intermediate skills and become certified to provide more advanced trauma care (i.e., become intermediate-level EMTs), although if they were so trained they might have trouble maintaining their skills and it is uncertain whether trauma-related mortality and morbidity would improve.

Severely injured rural patients should often be evaluated and stabilized expeditiously in the community hospital, and then triaged to the nearest trauma center (21,54). According to the American College of Surgeons, hospitals treating trauma should, at a minimum, have emergency medicine physicians available in the hospital around the clock. However, 24-hour physician coverage is often unavailable in rural hospital emergency rooms, and available physician and nursing staff may not have advanced trauma care skills. Improving the training of both emergency room nurses and physicians would improve rural trauma care, as would implementation of trauma protocols that help ensure that a physician and other necessary personnel are available by the time a trauma patient arrives at the hospital.

Many States have attempted to regionalize trauma care by designating or identifying hospi-

[4]Injury and trauma are synonymous terms.

tals according to their level of trauma care services. Most rural hospitals do not meet the requirements of even the lowest level of trauma care but nonetheless have an important role to play in providing trauma care in rural areas. Developing specific trauma care guidelines for rural hospitals might prove helpful to rural providers and clarify the rural hospital's role within the trauma care system. A system that integrates all levels of hospital care within a State promotes regionalization and is likely to improve rural trauma patient outcomes.

Research Needs

Before implementing programs to improve rural trauma outcomes, it would be useful to know more about the causes and consequences of rural trauma, where along the continuum of care deaths are occurring (e.g., during the prehospital or hospital phase), and whether these deaths are potentially preventable. Implementing programs without such information may lead to inefficient use of limited resources (24). To begin to understand where, along the continuum of care, resources could be targeted to improve the outcome of rural trauma patients, population-based studies need to be conducted in rural areas. Ideally, hospital discharge data would be examined so that the types of care and outcomes of patients that both live and die could be evaluated.[5] Because hospital discharge data may not be readily available, studies of trauma deaths could be conducted to see what proportion of them are preventable. Studies of preventable mortality will shortly be conducted with support from the Department of Transportation (24).

Research is also needed to evaluate the effectiveness of specific EMS interventions now commonly used. The evaluations must take place in both urban and rural areas, because some evidence suggests that some interventions that are inappropriate in urban areas may be effective in rural areas. Initiation of fluid resuscitation for patients who have lost a lot of blood, for example, is not indicated for patients in urban areas that are within 20 minutes of a trauma hospital but may be appropriate in rural environments where time-to-care may be longer.

The relative effectiveness of public education and law enforcement in improving injury rates in rural areas is another area worthy of investigation. Some practices of rural residents probably contribute to higher injury-related mortality. Only 25 percent of rural residents, for example, report using seat belts all or most of the time while driving, as compared to nearly 40 percent reported by urban residents. Public education, the enactment of State laws to require seat belt use, and enforcement of existing laws could contribute to lower injury-related mortality and morbidity.

The present impetus to improve EMS systems centers on the adequacy of trauma care. While trauma care is an important component of EMS care, the adequacy of nontrauma-related EMS services needs to be examined as well. There appears to be an excess of deaths among trauma victims in rural areas, but it is not clear to what extent these deaths are preventable through medical interventions. It may be that targeting resources to prevention may be more effective in reducing fatalities than improvements in trauma centers. EMS care is more likely to involve patients with medical conditions such as cardiac arrest and strokes than trauma, and in the case of sudden cardiac arrest, rural mortality might decline with EMS systems improvements such as implementing EMT-Defibrillator programs. Whether patients suffering from cardiovascular emergencies might benefit from other system-wide changes, such as more regionalized care, is uncertain. A few States have verification and designation standards for cardiac care facilities, but most do not.

OPTIONS FOR FEDERAL POLICY

While some problems associated with delivering EMS care in rural areas to widely dis-

[5]The Sensitivity Index Project, funded through DOT's National Highway Traffic Safety Administration, links statewide computerized crash reports with patient hospital records. This allows investigators to correlate factors such as EMS response time and seat-belt use to patient outcomes (53).

persed populations may seem intractable, many rural EMS problems can be resolved with additional targeted resources and effective planning and management. Among the most salient problems confronting rural EMS systems are:

- EMS personnel shortages;
- inadequate advanced training opportunities for available EMS providers;
- a lack of medical supervision of local EMS operations;
- antiquated equipment (e.g., communications equipment);
- poor public access to EMS; and
- an absence of regionalized systems of specialized EMS care, such as trauma systems.

The Federal role in supporting State EMS programs has waned in recent years, but evidence of serious impediments to quality EMS care in rural areas argues for an increased Federal role. Providing EMS services is largely a State and local government responsibility; Federal resources have never been consistently available or sufficient to rely on for EMS operations. Limited Federal resources might, however, successfully be used to:

- promote training of EMS providers,
- facilitate the development of national consensus guidelines or standards for prehospital EMS providers and EMS facilities,
- provide technical assistance to States,
- support EMS-related research and demonstration projects, and
- provide incentives for States to implement planning efforts.

It is in these areas that States continue to need Federal leadership (112).

Federal Initiatives in EMS Training

Option 1: Congress could fund the Department of Health and Human Services (DHHS) to provide assistance in improving the supply and level of skills of rural prehospital and hospital-based EMS providers. Increased Federal assistance could include support of EMS training and continuing education programs, and State recruitment and placement programs.

Rural areas are suffering shortages of prehospital care providers and are dependent on volunteer providers who tend to have less advanced training than their urban counterparts. Rural hospital-based nurses and physicians may not have specialized training in EMS care, but nonetheless provide essential services to EMS patients. Federal assistance to EMT, primary care, and nursing training programs could improve the general availability of EMS providers. EMT programs that are accessible to rural residents could be targeted, because shortages of rural volunteer EMTs are particularly acute. As the cost of EMT training and certification can be a deterrent for volunteers, States could be encouraged to subsidize training with Federal assistance. Providing assistance to State recruitment and placement programs could also improve the availability of EMS providers in rural areas.

Federal resources could also be directed to EMS continuing education that is accessible to EMTs, nurses, and physicians already practicing in rural areas. Making continuing education courses in emergency medicine available to rural providers could effectively improve the rural hospital's EMS medical response and the quality of the rural community's EMS system. Increased support for EMS-related training and continuing education could be administratively handled through, for example, the Health Resources and Services Administration's Bureau of Health Professions. Many professional and nonprofit organizations are involved in EMS-related training, but there is no Federal agency that monitors the availability or content of EMS training.

Option 2: Congress could require DOT to reevaluate the standard curricula for prehospital EMS providers.

Although there are recognized shortages of prehospital care providers, the specific set of

EMS skills required in rural and urban settings is uncertain. A reexamination of prehospital care training and curriculum is justified because there is considerable controversy surrounding the effectiveness of some standard prehospital interventions in both rural and urban settings. The standard curricula for prehospital providers, developed by DOT, could be reevaluated in light of the unique characteristics of rural EMS providers (i.e., most are volunteers) and the demands of rural EMS practice. DOT (NHTSA) is sponsoring a development conference on EMS training in early 1990 where both trauma and nontrauma EMS training requirements will be discussed. DOT could change the standard curricula for first responders, and for basic, intermediate, and paramedic-level EMTs, but EMT-Defibrillator training would fall outside of DOT's authority. DOT's conference on prehospital EMS provider responsibilities and training might help clarify what should be included in EMT curricula and might help reduce the extreme differences in training that currently exist.

Federal Guidelines or Standards

Option 3: Federal legislation could facilitate the development of national consensus guidelines or standards for prehospital EMS providers.

There are about 36 recognized levels of prehospital care providers across the Nation, and training requirements and levels of responsibility vary markedly by State. The American Society for Testing and Materials, a voluntary standard development organization, has published standards for some EMS personnel, but these have not been widely used. Federal legislation could ensure that national consensus guidelines or standards for prehospital EMS providers be developed following the National Development Conference on EMS training, sponsored by DOT, which is to be held in early 1990.

Option 4: Federal legislation could facilitate the development of national consensus guidelines or standards for specialized EMS facilities, such as trauma centers. Such guidelines or standards might delineate the role of small rural hospitals in EMS care.

Some proposed Federal EMS legislation ties receipt of EMS grants to adherence to a State plan that includes trauma facility designation according to national standards. Proponents of national trauma facility standards argue that few States have EMS systems that meet essential criteria, including facility standards, established by professional organizations (i.e., American College of Surgeons, American College of Emergency Physicians) and that such standards are required to assure EMS quality.[6] Opponents of EMS initiatives tied to facility standards argue that States have very diverse EMS needs and that imposing a national standard would provide little flexibility.

Three-quarters of the States have developed, or are developing, some type of trauma facility verification or designation program, but most adapt standards (like those developed by the American College of Surgeons) to meet State or regional needs. Developing national voluntary guidelines or standards might be preferrable to mandatory standards in light of States' diverse needs.[7] A consensus development conference, such as those sponsored by the National Institutes of Health, might provide a forum whereby national consensus guidelines or standards could be developed with advisement from profes-

[6]Recognizing that facility standards might not be appropriately applied in all areas, legislators have included provisions whereby a State could get a waiver of the proposed trauma facility standards after public notice and hearings.

[7]Existing Federal regulations recommend that Federal health and safety programs use national voluntary consensus standards (1 CFR Chapter 3 -1978). The Office of Management and Budget's Federal standards policy also recommends the use of national voluntary consensus standards (Circular A-119 of November 1982).

sional medical organizations and State and local officials.[8]

Some argue that the imposition of facility or system standards is premature in some areas and that such standards will doom many areas' programs to failure. Any guidelines or standards that are developed could be phased in so that resources could first be used to improve training and to upgrade communications and other equipment. This would help to ensure that when standards were imposed, personnel and equipment-related criteria could be met. Some opposition to the imposition of facility designation criteria and triage protocols may be alleviated through public and provider education.

Federal EMS Technical Assistance

Option 5: Congress could fund DOT and DHHS to augment technical assistance to State EMS offices.

The ability of States to provide technical assistance to EMS providers needs to be improved, especially for those States with large underserved rural areas. Specific types of technical assistance include:

- development of communications systems;
- enhancement of management skills (e.g., billing procedures, personnel practices);
- promotion of public education (e.g., raise public awareness of EMS system, injury prevention);
- delivering air medical services in rural areas;
- development of statewide or regional EMS surveillance systems and reporting practices; and
- implementation and adherence to quality assurance programs.

In many of these areas, Federal expertise is available to assist State EMS program directors. EMS-related technical assistance to States is currently available through DOT's National Highway Traffic Safety Administration. NHTSA assembles a team of technical advisors that may include experts in such areas as rural EMS delivery, data gathering systems, trauma systems, and the development of legislative proposals.[9] The assessment team makes recommendations to the States after comparing the status of EMS in the State to EMS system standards established by the assessment team (126). The scope of technical assistance offered by DOT extends beyond highway safety issues and is offered when requested by a State's EMS office. DOT supported the development of a computer simulation program for rural EMS system design that, if adapted to the microcomputer, could be a useful adjunct to providing technical assistance.[10]

The Centers for Disease Control (CDC) also has a technical assistance program through its Division of Injury Epidemiology and Control. CDC can offer technical assistance in many EMS-related areas such as injury surveillance, but there are areas of expertise that are lacking, such as EMS systems development. Less than one-half of State health departments report having injury reporting/surveillance systems and when data sources are available, States do not always use them (47). As EMS planning and quality assurance are facilitated by such surveillance systems, this appears to be an area where States may benefit from technical assistance.

Several tools are available for EMS systems to evaluate their performance. One method involves comparing a system's prehospital services for trauma patients to the experience of other EMS systems. A database that includes the experience of many providers can be used to develop norms or a "yardstick" against which they can compare their patient survival experi-

[8]The American Society for Testing and Materials (ASTM) has had several task groups addressing the development of a national consensus on guidelines for EMS facilities (ASTM Committee F30), but representatives of professional organizations such as ACS and ACEP no longer participate because of concerns about the appropriateness and applicability of the ASTM process to the field of EMS (53,63).

[9]EMS advisers assembled by DOT have provided assistance to eight States this year and plans are to extend assistance to eight more in calender year 1990 (24).

[10]This computer simulation model is described in app. B.

ence (88). Such a database is central to the Major Trauma Outcome Study. Here, data on trauma patients from over 100 hospitals are analyzed to establish norms (e.g., mortality, complications) by cause of injury and injury severity (23).

Federally Sponsored EMS Research and Demonstration Programs

Option 6: Congress could fund DOT and DHHS to augment their EMS research and demonstration programs and encourage the investigation of EMS problems unique to rural areas and providers. The research efforts of DOT's NHTSA and DHHS's National Center for Health Services Research and CDC could be coordinated to address a broad range of outstanding research questions.

EMS research and development efforts came to a virtual standstill following the demise of the EMS ACT in 1981. Under the EMS Systems Act (section 1205), the National Center for Health Services Research (NCHSR) was responsible for EMS applied research. The results of the NCHSR research conducted in the mid seventies has greatly influenced EMS practice and has been useful to rural providers. NCHSR-supported research showed, for example, that defibrillators could be effectively used by prehospital providers on patients suffering out-of-hospital cardiac arrests.

CDC, through its Division of Injury Epidemiology and Control, has recently established five Injury Prevention Research Centers and has funded over thirty 3-year research and demonstration projects.[11] DOT has a small research and development budget, but, these resources are used to investigate highway-related concerns. Additional funds could be used to expand and coordinate the research capabilities of NCHSR, DOT, and CDC.

Although these efforts are noteworthy, there are numerous outstanding EMS research questions with direct relevance to rural areas that are not being adequately addressed. These include such basic questions as, "is the demand for EMS different in rural as opposed to urban areas?" The results of such research could guide curriculum revisions and the development of any new prehospital provider standards or guidelines. Demonstration projects with an evaluation component could answer questions on the relative cost and effectiveness of innovative teaching strategies, such as home instruction using videocassette recorders for EMT training or rural emergency room nurse and physician continuing education. Such instruction might help to solve some of the EMT shortages experienced in many rural areas and improve the skill levels of existing rural providers.

Federal Incentives for Planning and EMS Systems Development

Optimally, EMS systems have ongoing, dependable State support. Several States have achieved self-sufficiency through innovative funding strategies (e.g., special funding through motor vehicle fees), but many State's EMS programs are underfunded and lack coordination. To promote State EMS system development and planning, existing Federal EMS program support could be augmented or new Federal EMS programs established.

Option 7: Congress could augment support of existing Federal programs that address EMS, namely the DHHS Preventive Health Block Grant Program and DOT's State and Community Highway Safety Grant Program. Consideration could be given to earmarking funds within these grant programs for EMS.

The DHHS Preventive Health Block Grant Program

States can use block grant money for a variety of purposes, and investment in EMS cannot be assured without earmarking some portion of the DHHS block grant for EMS. Earmarking would

[11]The grants were distributed among five major elements of injury control: epidemiology, prevention, biomechanics, acute care, and rehabilitation (27). Two of the funded projects relate to farm and rural injuries.

be helpful in those States that have not given high priority to EMS system development; but it would also mean that States with well-developed EMS systems would be required to expend Federal block grant funds on EMS rather than on other State priorities.

Augmenting current Federal EMS-related programs has the advantage of administrative ease and offers a flexible approach for States with diverse needs. States could use the additional block grant funds to invest in communications equipment and improve training opportunities within the State. A disadvantage of using this approach is that it would be difficult to impose any Federal EMS standards (e.g., designation of facilities) or to tie funds to the implementation of a State EMS plan, because under the block grant program the State has the discretion to use funds as it sees fit. Another disadvantage of this approach is that it is difficult to target Federal funds to States with identified EMS problems or, within States, to rural areas.

DOT's State and Community Highway Safety Grant Program

Augmenting DOT's State and Community Highway Safety Grant Program could be a more effective way to promote EMS system development than augmenting the DHHS Preventive Health Block Grant Program. Unlike DHHS, DOT makes EMS money available to States to implement a State Highway Safety Program that includes EMS. DOT has established EMS guidelines for States to follow in developing their highway safety program. With evidence that the chances of being seriously injured or dying if involved in a motor-vehicle accident are two to three times higher in rural than urban areas, there is a need to involve State highway safety programs and transportation experts in EMS systems development. DOT's program contains elements needed to promote EMS system development, but DOT's focus is on highway safety and trauma care. DOT's EMS guidelines are, however, generalizable to most emergency care (e.g., there are provisions for EMS training and emergency vehicle requirements).

DOT's grant program funds are now channeled to States through politically appointed State highway safety representatives. State DOT highway safety programs have been directed to coordinate their activities with State EMS offices, but there are still areas where there is a lack of coordination.

If additional support were available, many of the technical assistance, research and development, and training issues could be adequately addressed through interagency coordination and agreements. However, certain areas of expertise are missing from the current Federal EMS-related agencies, specifically in the areas of nontrauma-related EMS care and EMS systems development.

Option 8: Congress could establish a new EMS categorical grant program within DHHS.

Rather than augmenting current Federal EMS programs, a categorical grant program could be reestablished within DHHS to specifically promote EMS systems planning. The availability of grants to States could be tied to the development and implementation of a State EMS plan. Such a program would reestablish a strong Federal EMS presence within DHHS, which could be coordinated with DOT's EMS program. If such a presence were established, many problems related to coordination of current Federal efforts might be solved or mitigated.[12] If new Federal resources were directed to resolve some rural EMS system problems, methods to allocate resources to those areas most in need could help assure that limited resources are effectively used.

[12]There was an active Interagency Committee on EMS from 1974 to 1981. Since then, a Federal Interagency Committee on Emergency Medical Services (FICEMS) was chartered by the Federal Emergency Management Agency (FEMA) but there is a need for improved interagency communication, particularly in the areas of training, communications, and research and development (125).

Targeting EMS Resources To Rural Areas

Option 9: To accommodate the diversity of rural areas, any Federal EMS resources provided to States could be tied to implementation of a comprehensive State plan that addresses that State's rural EMS system problems.

Different approaches could be used to target Federal EMS resources to rural areas. Resources can go directly to rural areas, or they can be allocated to States based on a formula reflecting their rural population. Under the 1973 EMS Systems Act, grants could be made to any of 303 EMS service areas, some of them rural areas. Sometimes, only certain areas within a State were funded under the competitive grant process. The grant program promoted regional EMS planning but not necessarily statewide planning. If funds are to be directed to States and some funds are to be used to solve rural EMS problems, how to allocate those funds to "rural" areas is an important issue. An allocation formula might be based on the proportion of the population that resides in nonmetropolitan areas, population density, square mileage of the State, or another indicator of rurality. Each has its advantages and disadvantages.

The basis used for allocation can have a substantial influence on the distribution of funds. For example, over 80 percent of the Idaho population resided in nonmetropolitan areas in 1980, but that population numbered less than one million. Texas, on the other hand, had less than 20 percent of its population residing in nonmetropolitan areas but had more than three times the number (over 3 million) of nonmetropolitan residents. An allocation formula based on the proportion of nonmetropolitan residents might leave States with very large nonmetropolitan populations at a disadvantage. In other States, rural EMS problems may be related to the presence of large disadvantaged populations (e.g., those lacking in health insurance and with poor health status). In these States, an allocation formula based on the composition, as well as the relative size of the nonmetropolitan population (e.g., percentage of the population that is uninsured) might be more appropriate. In some "frontier"[13] States, rural EMS problems can be directly related to large geographic EMS service areas that are sparsely populated. Here an allocation formula based on population density or dispersion might be appropriate.

There may be some rural areas where direct ongoing subsidies are required to maintain services. An EMS system is much like a public utility offering electric or water service, in that providing services becomes disproportionately more costly as the number of consumers declines and becomes dispersed over wide areas. Ongoing subsidies in such situations are not new; subsidies have been used to finance some rural electrification projects, and urban mail services subsidize the more expensive rural routes. Some communities can form cooperatives or linkages to broaden their service area and conserve resources, but other communities are isolated and cannot. Helicopters and airplanes may be used to transport some isolated patients to a medical facility, but these cannot replace an appropriate level of first response.

[13]The term "frontier" has been used to describe areas with six or less residents per square mile (50).

Chapter 2
Definition of Terms

EMERGENCY MEDICAL SERVICES

Emergency medical services (EMS) include the personnel, vehicles, equipment, and facilities used to deliver medical care to those with an unpredicted immediate need outside a hospital and continued care once in an emergency facility (127).[1] EMS *systems* are generally organized at the State or regional level to provide coordinated delivery in an appropriate geographic area (62). Implementing comprehensive EMS systems has been shown to save lives and reduce disabilities (76,127). The primary goals of an EMS system are to:

1. provide rapid transportation to a medical facility;
2. provide immediate medical assistance at the scene and while in transit; and
3. have a coordinated, tiered level of hospital care so that the most seriously injured or ill patients are quickly triaged to, and cared for at specialized facilities, and the less severely injured or ill patient cared for at less specialized facilities.

In reaching these goals, EMS systems extend beyond the bounds of what is traditionally viewed as the "medical system," often overlapping with other public safety systems such as local fire and police services. Rural EMS systems rely heavily on community volunteers and may therefore serve as an important interface between the public and the local health care system (85).

EMS systems include several components:

Public Access

Public access to an EMS system is optimally achieved through a coordinated communications system. Centralized communications centers may be accessed directly by telephone or radio using a 911, 800, or designated seven-digit number (sometimes referred to as universal access). EMS systems can also be accessed through fire and police departments, hospitals, or telephone operators.

Prehospital Response

Public Safety Response

Prehospital response may begin shortly after an emergency victim is detected and before EMS professionals arrive. Bystanders trained in cardiopulmonary resuscitation (CPR) or first aid may provide assistance at the site or individuals trained in basic emergency skills may be called to the site as "first responders" until the ambulance or other EMS professionals arrive. Fire and police officials or community members may be trained as first responders.

EMS Professional Response

After the EMS system has been called, a vehicle appropriately staffed and equipped is dispatched to the scene. Depending on the nature of the emergency, extrication may be required, and medical stabilization or treatment initiated. EMS personnel select a facility to take the patient to (sometimes using transport guidelines), and provide transportation to that facility while continually monitoring and administering care to the patient. Prehospital providers are usually emergency medical technicians who provide basic life support care, which includes basic emergency care and CPR, and/or advanced life support, which may include external defibrillation for cardiac arrest patients and more invasive procedures such as starting intravenous lines. Prehospital care providers are ideally provided medical advice from physicians via vehicle-to-hospital communications. In addition to providing such "on-line" medical control, physicians may also participate in "off-line" medical control through designing medical protocols that guide prehospital providers' care. Any in-transit communication of the patient's condition helps the receiving facility prepare for the arrival of the patient.

Transportation

Most EMS transportation is provided by ambulances. Helicopters are often used to transport trauma patients to trauma centers, while airplanes or helicopters are used to transfer stabilized patients from one hospital to another. The duration of the

[1]Some include rehabilitative care in the definition of an EMS system. While OTA recognizes the importance of the continuum of care required for many EMS patients, rehabilitative care is not specifically discussed in this report.

transportation phase is dependent on three factors: physical distance to be covered; mode of transportation (land, air, water); and the type and condition of the roadway, airway, or water.

Medical Response

There are three levels of medical response:

- Primary medical response involves nonspecialty providers in facilities such as small community hospitals. Providers at these facilities can resuscitate and stabilize critically ill or injured patients.
- Secondary medical response offers definitive treatment by specialty providers (e.g., surgeons, anesthesiologists). Secondary facilities generally have a physician available 24 hours a day and lab and x-ray services available within 30 minutes.
- Tertiary medical response involves highly specialized and technical services (e.g., burn care, spinal cord injury care). Generally, tertiary facilities such as trauma centers need high patient volumes to operate efficiently.[2]

A number of professional organizations have established guidelines to categorize hospitals by the level of emergency capabilities. The American College of Surgeons, for example, has guidelines for the designation of trauma centers (4). The American College of Emergency Physicians has issued guidelines that include prehospital care (3) (see ch. 5).

The major factor affecting the outcome of a critically injured or ill patient is time to definitive care, therefore, efficient operation of an EMS system by trained personnel is essential. Trauma patient outcomes are best when patients are identified, transported, and cared for within a critical "golden hour" (127). For rural residents, this can be achieved with initial resuscitation and stabilization provided by prehospital providers at the scene and during transport; more advanced stabilization at the rural hospital; followed by rapid transfer to tertiary care facilities (20,21,46,128). Optimal EMS care in rural areas requires that the levels of medical response located in both rural and urban areas be well coordinated. EMS systems must also be coordinated with other public safety agencies such as fire, police, and disaster programs.

The responsibility of overseeing a State's EMS system generally rests with a State EMS director. The State EMS director may, among other things, be responsible for training and certifying EMS providers, certifying ambulances and air-medical transportation services, and ensuring the coordination of levels of EMS care provided within the State's hospitals. At the local level, EMS care may be organized through the county, as a separate department of local government similar to those offering police and fire protection. Alternatively, EMS services may be offered through an existing municipal agency, such as the fire department, where providers may be cross-trained to assume both EMS and fire-fighting responsibilities. Hospital emergency departments, private ambulance services, or independent voluntary agencies may also operate and manage a community's EMS system (42,75). However EMS services are organized, statewide or regional EMS patient surveillance systems, such as trauma registries, can be used by EMS planners to evaluate the EMS system. All EMS systems need not only an administrative director, but a medical director who prescribes, oversees, and is accountable for medical care provided by the service or system (53). An EMS system may include a single local service or it may encompass an entire State.

RURAL AREAS

Urban and rural areas are often defined using the designations of either the Office of Management and Budget (OMB) or the Bureau of the Census. Rural areas are the remaining areas not captured in either OMB's "metropolitan statistical area" (MSA) designation or in Census' urban or urbanized area definitions. Counties are the building blocks of OMB's MSAs and are easy to use, because county-based data are readily available. One or more counties form an MSA on the basis of population size and density, plus the degree of area-wide economic integration as reflected in commuting patterns. MSAs include a densely populated urban core (called an urbanized area), with at least 50,000 residents, that is part of a county or counties comprised of at least 100,000 residents. The Census'

[2]Trauma centers and trauma systems are one component of EMS care and systems. Trauma centers offer definitive care for the critically injured patient. For patients with noninjury-related medical conditions, the tertiary medical response may involve other specialized hospitals or centers.

urban and urbanized area definitions rely on settlement size and density without following county boundaries, making them more difficult to use.[3]

Both methods identify about a quarter of the U.S. population as rural or "nonmetropolitan," but these populations are not identical. For example, about 40 percent of the Census-defined rural population live within MSAs, and 14 percent of the MSA population live in Census-defined rural areas.

This report will refer to nonmetropolitan areas as rural unless specified otherwise. It seems appropriate to use MSAs to describe "urban" and "rural" access to, and organization of, EMS services, because EMS systems are generally organized along these lines. Specialized EMS services, such as trauma centers, for example, are generally located within the more densely populated urban areas of MSAs and become less available as you move out into the less populated non-MSAs. Nonmetropolitan hospitals are generally smaller than metropolitan hospitals and tend to have fewer specialized services available (6).

Unfortunately, statistics relevant to EMS are not presented in a standardized fashion. Comparing EMS-related data from one source to another, therefore, is almost impossible. The Department of Health and Human Services (DHHS), for example, publishes vital health statistics (e.g., injury-related deaths) for metropolitan and nonmetropolitan counties,[4] but the Department of Transportation (DOT) provides data in their Fatal Accident Reporting System and National Accident Sampling System (122) using their own definition of rural.[5]

In addition to using a standard definition of "rural," it is important to present data for rural subpopulations. Dichotomous measures of urbanity/rurality not only obscure important differences between urban and rural areas but also wide variations within rural areas. Consequently, there have been recommendations to implement a standard rural typology that would capture the elements of rural diversity and improve use and comparison of data. Several rural "typologies" or classification schemes have been developed for nonmetropolitan areas that may prove useful in presenting rural health data (50). It would be helpful to use such typologies to present data on rural injury so that injuries unique to such environments as farms and mining areas could be identified.

[3]For detailed information on definitions of rural areas, see "Defining 'Rural' Areas: Impact on Health Care Policy and Research," OTA Staff Paper, July 1989 (available through GPO stock No. 052-003-01156-5 or by calling the OTA Health Program at 202-228-6590).

[4]DHHS subdivides metropolitan and nonmetropolitan areas into urban and "not urban" places. DHHS defines nonmetropolitan urban places as areas with populations of 10,000 or more.

[5]According to DOT, urban areas are areas within boundaries fixed by State or local officials that have a population of 5,000 or more, and are not within another urban area. Rural areas are those outside of the boundaries of "urban" areas (122). Approximately one-quarter of the population of MSAs meet DOT's definition of "rural" and nearly one-third of non-MSAs meet DOT's definition of "urban."

Chapter 3

The Demand for EMS Services in Rural Areas

INTRODUCTION

Medical conditions that may require emergency medical services (EMS) include medical emergencies, such as heart attacks, and critical injuries such as those sustained in motor vehicle crashes and occupational accidents. National data on what medical conditions precipitate an EMS call are not available, but some State data suggest that EMS care is needed as frequently, if not more frequently, for medical conditions, such as heart attacks and respiratory distress, as for trauma (tables 3-1 and 3-2). This chapter describes urban and rural differences in demand for EMS services and in injury morbidity and mortality.

Each person is likely to need ambulance service at least twice in his or her lifetime, but a population of 10,000 residents generates only one true emergency call a day (31). Small communities must be prepared for relatively low volumes of calls that may not be well distributed over the year. Severe trauma may occur infrequently, but a community may have to deal with multiple victims of an automobile crash at one time.

The demand for EMS services will increase in a continuous fashion as the size of the service population increases, but the capacity of the EMS system to respond increases in discontinuous steps, especially in small communities. A small community with a two-ambulance system, for example, cannot meet a 20 percent increase in demand with a 20 percent increase in capacity; acquiring a new ambulance and staff would represent an increase in capacity of 50 percent (132).

Many nonmedical factors contribute to the demand for EMS services. Some individuals who need EMS services do not use them because they do not realize that EMS services are required, lack services within their area, don't know how to access the system, or may be unable to pay for the services. Conversely, some individuals use EMS services for nonemergencies. This may occur if other health services are unavailable or less convenient, or if the public is uninformed of the purpose of EMS.

URBAN AND RURAL DIFFERENCES IN DEMAND FOR EMS SERVICES

There are marked urban/rural differences in EMS service use in three States where statewide, computerized, ambulance-use data are available (Texas, South Carolina, New York).[1] Ambulance-transported patients in rural Texas are more likely to be suffering from a heart condition or stroke than urban residents and less likely to suffer from internal injuries, injuries to the spine or brain, and lacerations or penetrating trauma (table 3-1) (134). The higher demand for EMS intervention for acute medical conditions such as heart attacks or strokes is likely explained by the older age distribution of rural residents.[2]

Ambulance services are used more frequently by the elderly in rural than urban areas. Over half (54 percent) of ambulance-transported patients in rural Texas were age 65 or older (29 percent were age 80 or older) as compared to 29 percent in urban areas. There are similar findings in New York State where over one-half (54 percent) of patients transported by ambulance in rural counties were age 60 or older, compared to 42 percent for urban counties (42).[3] South Carolina, in contrast, had less than one-quarter of patients age 65 or older among urban and rural ambulance transports in 1988.

Rural ambulance calls are more likely to be "urgent," or "critical" in rural than urban areas of Texas and South Carolina (44,134).[4] In Texas, for example, 44 percent of 1988 rural ambulance runs were categorized as "urgent" and 7 percent "critical" as compared to 31 percent, and 4 percent, respectively, for urban ambulance runs (134). A large percent of rural calls in both Texas and

[1]These States were identified by calling the American Ambulance Association, and participants of the OTA/DOT Rural EMS Workshop. States with statewide, computerized, ambulance data that could be analyzed by metropolitan and nonmetropolitan area provided the tabulations for OTA.

[2]Thirteen percent of the nonmetropolitan population is elderly (i.e., age 65 or older) while only 11 percent of the metropolitan population is elderly (113).

[3]Ambulance utilization data were available for selected urban and rural counties (42).

[4]Similar information was not available from New York.

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Table 3-1—Prevalence of Injuries and Illness Among Patients Transported by Ambulance in Texas, 1988[a]

Type of illness or injury	Percent of transports		
	Total	Metro	Non-metro
Illness:			
Heart complications	12.6	12.2	15.1
Strokes-CVA[b]	4.1	3.6	7.0
Respiratory distress	7.4	6.9	10.9
Diabetic complications	2.7	2.6	3.5
Gastrointestinal illnesses	5.1	4.8	7.2
Convulsions or seizures	3.6	3.7	3.0
Allergic reactions	0.5	0.5	0.5
Fainting	2.0	2.1	1.6
Infectious diseases	1.0	0.9	1.4
Emotional or mental distress	2.6	2.8	1.4
Other illnesses	12.1	12.0	12.6
Injury:			
Lacerations or penetrating trauma	9.4	9.7	7.5
Internal injuries	2.7	2.8	1.8
Injuries to spine or brain	4.5	4.6	3.4
Multiple injuries	0.5	0.5	0.7
Fracture or dislocation	10.9	10.4	13.7
Scrapes, bruises, or cuts	10.9	11.7	6.1
Sprains or strains	4.3	4.6	2.1
Burns	0.6	0.6	0.4
Drowning, suffocation, or choking	0.3	0.4	0.2
Other injuries	2.5	2.7	1.6
Perinatal care:			
Obstetric or gynecological	1.9	2.0	1.5
High-risk infants	0.2	0.2	0.1
Substance abuse:			
Drug overdose or poisoning	1.6	1.7	0.8
Acute alcohol intoxication	0.8	0.9	0.5
No information available	17.2	16.8	19.8
Total number of patients	51,853	44,527	7,326

[a]These data are based on ambulance run reports of a representative sample of Texas ambulance services. There were an estimated one million ambulance runs in Texas in 1988. More than one condition can be reported for each patient. Numbers in the table represent the percent of ambulance transports for reported types of illness and injury.
[b]CVA = Cardiovascular accident.

SOURCE: Texas Department of Health, Austin, TX, August 1989.

South Carolina are for transportation. In South Carolina, for example, about 16 percent of ambulance calls in rural areas are for transportation to medical exams, as compared to 10 percent in urban areas (44).

Injury is a major problem in rural areas, particularly injuries sustained in motor vehicle accidents. Injuries are more likely than other emergency conditions to require specialized services such as trauma centers which are usually not immediately available in rural areas.

Injury

Injury is the leading cause of death among persons 1 to 44 years old (119) and is the leading cause of years of potential life lost before the age of 65 (121). Injuries occur as, or less frequently in rural areas than in urban areas (see table 3-3) and the types of injuries that occur in these areas are similar (table 3-4).[5] When injuries do occur, however, they appear to be more serious in rural areas; injured rural residents have more restricted-activity days and bed days than injured urban residents (table 3-3). This is especially true for injuries occurring at home.

Death rates from unintentional injuries (both motor vehicle and nonmotor vehicle related) are twice as high in remote rural areas than in the largest cities (figure 3-1) and death rates are inversely related to population density (13). The chance of dying in a rural area, if severely injured, are three to four times higher than in urban areas (19,62). Some evidence suggests that aspects of the EMS system may contribute to the higher death rates. For example, younger and generally healthier adults die from less severe injuries in rural nontrauma center hospitals than in urban trauma center hospitals (66).

Occupational Injuries

While national injury data do not reflect higher injury rates in rural areas, certain rural subpopulations have more injuries because of the types of occupations they practice. Approximately 10 percent of employed rural residents 16 years of age and older are employed in two of the most hazardous occupations in America—farming and underground mining. Farming encompasses a wide range of activities that may pose health hazards, including the use of farm machinery and tools and exposure to chemical fertilizers and pesticides. Mining hazards include cave-ins, explosions, fires, and the inhalation of dust (78). Work-related deaths occur four to five times more frequently among mining and agricultural workers than among workers as a whole, and disabling injuries occur two to three times more often (72) (see table 3-5).

Motor Vehicle Crashes

One-third of all injury-related deaths are attributable to motor vehicles. Among those under age 35, motor vehicle crashes are the leading cause of death (12). There is wide geographic variation in motor

[5]These data are limited insofar as they rely on self-reported injuries reported by phone interview (i.e., National Health Interview Survey).

Table 3-2—Prevalence of Injury and Illness Among Calls for EMS Services in South Carolina, 1988[a] (percent)

	Metro			Non-metro		
Primary complaint	Jan.-April	May-July	Aug.-Dec.	Jan.-April	May-July	Aug.-Dec.
Total injury	15	27	27	17	26	27
Fracture	3	5	5	4	6	5
Spinal injury	3	5	6	2	5	5
Laceration	3	5	4	3	4	4
Abrasion/contusion	2	4	3	2	4	3
Head injury	1	2	3	1	3	3
Multitrauma/shock	0	1	2	0	1	2
Hemorrhage	1	1	1	1	1	1
Dislocation	0	1	1	1	1	1
Puncture/stab	0	1	1	0	1	1
Gunshot wound	0	1	1	0	1	1
Burn	0	0	0	0	0	1
Total cardiovascular	14	11	11	14	12	11
Coronary problem	9	7	7	8	7	7
CVA/TIA/stroke	2	2	2	2	2	2
Cardiac arrest	2	1	1	2	2	1
Hypertension	1	1	1	1	1	1
Congestive heart failure	1	0	0	1	1	0
Other medical	19	16	16	17	15	15
Vomiting	1	1	1	1	0	0
Gastro-intestinal problems	2	2	2	2	1	1
Genito-urinary problems	1	1	1	0	0	0
Hyperventilation	1	1	0	0	0	0
Respiratory distress	6	4	5	6	5	5
Seizure	3	3	3	3	3	3
Diabetic reaction	1	1	1	2	2	2
Insulin shock	0	1	0	0	0	0
Fainting	1	1	1	1	1	1
Unknown medical complaint	2	2	2	2	2	2
Total medical	33	27	27	32	27	26
Psychiatric/behavioral/drugs/alcohol:						
Psychiatric/behavioral	2	2	1	1	1	1
Overdose	2	1	2	1	1	1
Alcohol-like impairment	1	1	1	1	1	1
OB/GYN total	2	2	2	2	2	2
Obstetric—prenatal	1	1	1	1	1	1
Obstetric—emergency	1	1	1	1	1	1
Transport for exam	11	11	10	16	15	17
Nonemergency transport	1	1	1	2	1	1
No transport	13	13	13	11	13	11
DOA-total:	3	2	2	3	2	3
DOA—no transport	2	1	2	1	1	1
DOA—transport	1	1	1	1	1	1
Canceled call:	9	6	6	7	6	6
False call	2	2	2	1	1	1
Missing/wrong code	7	6	5	5	4	4
Total number of patients	9,958	12,524	12,888	5,256	7,572	7,016

[a]These data are based on a sample of 192 service providers' ambulance run reports. One primary complaint is reported for each call. Numbers in the table represent the percent of ambulance service calls for primary complaints. Conditions representing less than 1 percent of calls were not listed but are included in totals (e.g., drowning is included in total injury).

KEY: CVA = cardiovascular accident; DOA = dead on arrival; EMS = emergency medical services; OB/GYN = obstetrics-gynecology; TIA = transient ischemic attack.

SOURCE: South Carolina Department of Health and Environmental Control, Columbia, SC, September 1989.

vehicle crash mortality (figure 3-2) and there is an inverse relationship between population density and mortality (compare figure 3-2 map showing areas with high motor vehicle crash-related mortality to figure 3-3 map showing population density). Other evidence suggests that a disproportionate number of motor vehicle-related deaths occur in rural areas in general (i.e., not just rural areas with low population density) (figure 3-4). More than half (56.9 percent) of fatal traffic accidents occur in rural areas (as

Table 3-3—Number of Episodes of Persons Injured and Number of Associated Restricted-Activity Days and Bed Days[a] by Whether in Moving Motor Vehicle, Whether at Work, Place of Accident, and Place of Residence: United States, 1987

Type of episode	Number per 100 persons per year				Number of restricted-activity days (per 100 persons per year)				Number of bed days (per 100 persons per year)			
	MSA[b]				MSA				MSA			
	All	Central city	Not central city	Non-MSA	All	Central city	Not central city	Non-MSA	All	Central city	Not central city	Non-MSA
All episodes	26.6	25.8	27.2	24.0	255.2	277.7	239.9	278.1	80.8	89.6	74.8	83.4
Moving motor vehicle:												
Total	2.6	2.1	2.9	2.0	56.5	70.7	46.8	53.1	17.9	23.7	13.9	19.2
Traffic only	2.1	1.6	2.5	1.8	49.3	62.3	40.5	43.8	15.9	20.5	12.8	15.4
Non-moving motor vehicle	24.0	23.7	24.3	21.7	197.0	204.7	191.7	221.9	62.4	65.6	60.3	63.9
At work[c]	5.3	5.0	5.4	5.0	96.8	97.9	96.0	100.4	32.2	39.2	27.4	23.0
Not at work	15.8	16.2	15.4	13.2	170.2	198.2	150.8	216.4	49.3	53.5	46.3	72.0
Place of accident:												
At home	8.9	9.1	8.7	8.4	56.4	55.9	56.7	85.0	16.7	11.6	20.2	29.6
Street or highway	3.5	3.0	3.8	2.4	62.7	78.5	52.0	53.9	20.6	26.7	16.5	17.0
Industrial place	3.2	2.8	3.4	2.9	52.7	57.8	49.2	53.0	17.5	23.1	13.7	9.3[d]
Other	6.8	7.1	6.6	6.0	58.5	59.5	57.9	61.1	15.4	16.8	14.5	18.3

[a]Estimates of activity restriction and bed days are based on the present effects of the injuries no matter when they occurred.
[b]MSA = metropolitan statistical area.
[c]For currently employed 18 years of age and over only.
[d]Figure does not meet standard of reliability or precision.

SOURCE: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Center for Health Statistics, *Current Estimates from the National Health Interview Survey: United States, 1987*, Series 10, No. 166, DHHS Pub. No. (PHS) 88-1594, tables 51, 53, and 55, September 1988.

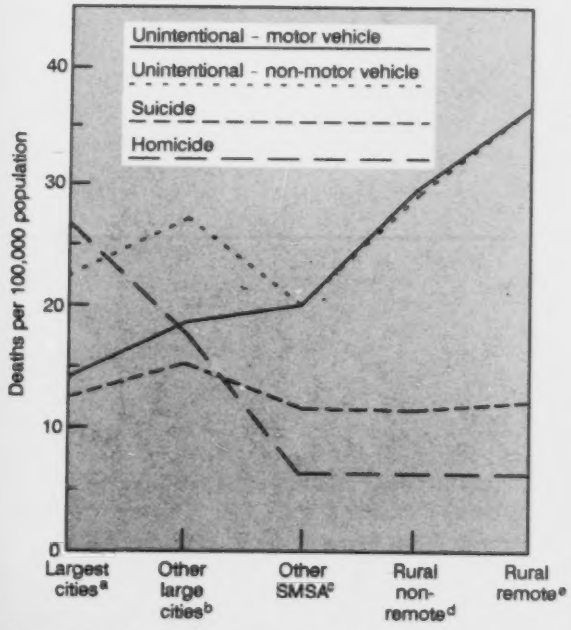
Table 3-4—Average Annual Number of Injuries[a] Per 100 Persons Per Year, by Place of Residence and Type of Injury: United States, 1980-81

Type of injury	MSA[b]			Non-MSA
	All	Central city	Not central city	
All injuries	33.2	32.4	34.2	32.6
Skull fractures and intracranial injuries	1.0	1.2	1.0	0.8
Fractures of lower limb	0.9	0.7	1.0	1.0
Fractures of upper limb, neck, and trunk	1.8	1.5	1.9	2.0
Dislocations	0.6	0.6	0.6	0.6
Sprains and strains—total	7.6	8.0	7.9	6.9
Open wounds and lacerations	8.0	7.9	8.4	7.8
Superficial injuries	1.6	1.7	1.6	1.6
Contusions	5.2	4.4	5.7	5.3
Burns	1.0	1.0	0.8	1.2
Toxic effects—nonmedical	0.8	0.9	0.8	0.8
All other injuries	4.6	4.5	4.6	4.7

[a]Injuries self-reported in the Health Interview Survey.
[b]MSA = metropolitan statistical area.

SOURCE: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Center for Health Statistics, *Types of Injuries and Impairments Due to Injuries: United States*, Series 10, No. 159, DHHS Pub. No. (PHS) 87-1587, table 6, November 1986.

Figure 3-1—Death Rates From Unintentional Injury, Suicide, and Homicide by Place of Residence, 1977-79



[a]Residents of cities with 1 million or more population.
[b]Residents of cities with population between 250,000 and 1 million.
[c]Residents of Standard Metropolitan Statistical Area (SMSA) counties, excluding residents of cities of 250,000 or more.
[d]Residents of nonmetropolitan counties that do not meet the definition of "rural remote."
[e]Residents of nonmetropolitan counties that are not adjacent to an SMSA and have no settlement as large as 2,500 persons.

SOURCE: Susan P. Baker, Brian O'Neill, and Ronald S. Karpf, *The Injury Fact Book* (Lexington, MA: D.C. Health & Co., 1984). Reprinted with permission.

defined by DOT) (123) whereas only about one-third of the population resides there.

What accounts for the excess motor-vehicle deaths is unclear. Motor vehicle accidents do not seem to occur more frequently in rural areas. In 1986, nearly one-fifth (18 percent) of people involved in motor vehicle accidents were in rural areas (as defined by DOT) at the time of the accident (table 3-6). Given that approximately one-third of the U.S. population is rural (as defined by DOT), this level of accident occurrence may even be low.

Despite the fact that accidents seem to occur less often in rural areas, persons involved in rural accidents are three times more likely to sustain serious or untreatable injuries than those in urban areas (table 3-6). Many more rural than urban accidents occur in areas with higher speed limits—nearly half (48.7 percent) of the accidents in rural areas took place in areas with speed limits of 55 MPH, compared to 8.7 percent in urban areas (see table 3-6). People involved in accidents in higher-speed-limit rural areas are two to three times as likely to sustain serious or untreatable injuries than those involved in higher-speed-limit urban areas (2.4 percent v. 0.9 percent) (see table 3-6).

Possible explanations for higher rates of motor vehicle-related injury and death in rural areas include (14):

- poorer road conditions and the absence of safety features such as guard rails;

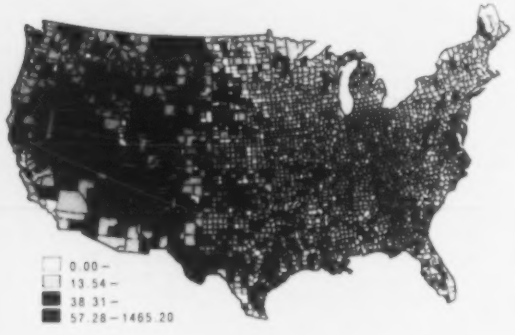
Table 3-5—Death and Disabling Injury Rates Among Workers by Industry, 1988

Industry[a]	Workers[b] (in 1,000s)	Deaths[c] Number (in 1,000s)	Deaths[c] Rate (per 100,000s)	Disabling injuries[d] Number (in 1,000s)	Disabling injuries[d] Rate (per 1,000)
All industries	114,300	10,600[e]	9	1,800	16
Agriculture	3,100	1,500	48[f]	140	45
Mining, quarrying	800	200	25	30	38
Construction	6,500	2,200	34	210	32
Manufacturing	19,500	1,100	6	350	18
Transportation and public utilities	5,800	1,400	24	140	24
Trade	27,000	1,100	4	320	12
Services	34,600	1,500	4	330	10
Government	17,000	1,600	9	280	16

[a]Agriculture includes forestry and fishing. Mining and quarrying includes oil and gas extraction. Trade includes wholesale and retail. Services includes finance, insurance, and real estate.
[b]Workers are all persons gainfully employed, including owners, managers, other paid employees, the self employed, and unpaid family workers, but excluding private household workers.
[c]Unintentional injury death (ICD underlying cause of death codes E-800-E949). Death from accident is a death which occurs within 1 year of the accident.
[d]Disabling injury is an injury causing death, permanent disability, or any degree of temporary total disability beyond the day of the accident.
[e]About 3,900 of the deaths and 200,000 of the injuries involved motor vehicles.
[f]Agriculture rate excludes deaths of persons under 14 years of age. Rates for other industry divisions do not require this adjustment. Deaths of persons under 14 are included in the agriculture death total.

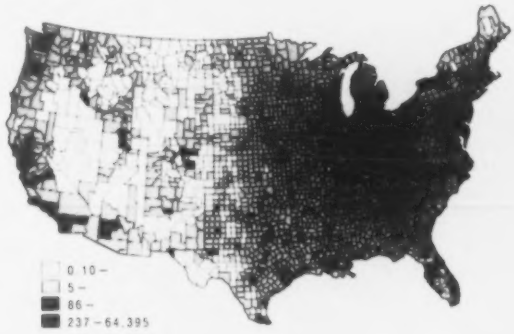
SOURCE: National Safety Council estimates (rounded) based on data from the National Center for Health Statistics, State vital statistics departments, and State industrial commissions. Numbers of workers are based on Bureau of Labor Statistics data and include persons aged 14 and over.

Figure 3-2—Motor Vehicle Related Death Rates



SOURCE: Baker et al., NEJM 316(22) page 1385.

Figure 3-3—Population Density



SOURCE: Baker et al., NEJM 316(22) page 1385.

- a greater likelihood of travel at extremely high speeds (65 MPH or greater);
- greater use of utility vehicles (jeep-like vehicles) and pickup trucks, which are associated with high death rates;
- lack of use of seat belts; and
- greater distances between emergency facilities and reduced access to major trauma centers.

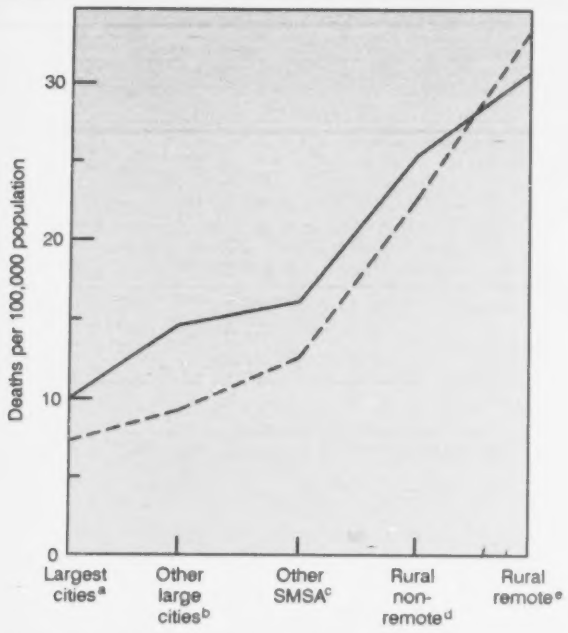
Higher death rates in rural counties are not explained by travel in rural areas by residents of more densely settled areas[6] or by a large volume of travel on major routes (14). In fact, none of the Federal interstate highways are distinguishable on the map as connecting a string of counties with high death rates (see figure 3-2).

Reducing the motor vehicle fatality rate to no greater than 18.0 per 100,000 population is one of the national 1990 objectives for injury prevention and control (119).[7] This goal has been achieved in U.S. urban areas, where the motor vehicle accident mortality rate was 17.3 in 1986 (see table 3-7). In contrast, the rate for rural areas was 28.4. The U.S.

[6]Motor-vehicle crash death rates were also highest in rural areas when calculated from National Center for Health Statistics data that records the deceased county of residence instead of the place of accident occurrence.

[7]The goal for the year 2000 is 17.0 per 100,000 population (24).

Figure 3-4—Death Rates From (Motor Vehicle Occupants) Motor Vehicle Crashes by Place of Residence, 1977-79



[a]Residents of cities with 1 million or more population.
[b]Residents of cities with population between 250,000 and 1 million.
[c]Residents of Standard Metropolitan Statistical Area (SMSA) counties, excluding residents of cities of 250,000 or more.
[d]Residents of nonmetropolitan counties that do not meet the definition of "rural remote."
[e]Residents of nonmetropolitan counties that are not adjacent to an SMSA and have no settlement as large as 2,500 persons.

SOURCE: Susan P. Baker, Brian O'Neill, and Ronald S. Karpf, *The Injury Fact Book* (Lexington, MA: D.C. Health & Co., 1984). Reprinted with permission.

1990 objective would be achieved if there was a 30 percent reduction in the number of rural motor vehicle fatalities (table 3-7). While there is no clear explanation for the dramatically higher mortality rate in rural areas, preventive efforts in rural areas and improving rural EMS systems could prove to be effective means of realizing the Nation's objective.

Table 3-6—Passenger Car Occupant Injury by Land Use and Speed Limit, 1986

	Vehicles		Occupants	All injuries (AIS ≥1)[a]		Serious to untreatable trauma (AIS ≥3)[a]	
	Number (in 1,000s)	Percent	Number (in 1,000s)	Number (in 1,000s)	Percent	Number (in 1,000s)	Percent
Urban:							
25 MPH or less	1,342	19.6	2,000	349	17.4	8	0.4
30 to 40 MPH	4,064	59.4	6,140	1,281	20.9	25	0.4
45 to 50 MPH	839	12.3	1,245	323	25.9	8	0.6
55 MPH	596	8.7	901	232	25.7	8	0.9
Total urban	6,841	100.0	10,286	2,185	21.2	49	0.5
Rural:							
25 MPH or less	161	11.5	252	40	15.9	1	0.4
30 to 40 MPH	322	23.0	554	152	27.4	3	0.5
45 to 50 MPH	234	16.7	362	109	30.1	7	1.9
55 MPH	681	48.7	1,137	349	30.7	27	2.4
Total rural	1,398	100.0	2,305	650	28.2	38	1.6
U.S. total	8,239		12,591	2,835	22.5	87	0.7

[a]AIS (Abbreviated Injury Scale) is used to rate the severity of trauma. A score of 1 indicates minor trauma; 2 indicates moderate trauma, 3 serious trauma, 4 severe trauma, 5 critical trauma and 6 maximum trauma (currently untreatable). The scale was developed by the American Association for Automotive Medicine.

SOURCE: U.S. Department of Transportation, National Highway Traffic Safety Administration, *National Accident Sampling System, 1986*, table 111-21.

Table 3-7—Metropolitan (MSA) and Non-Metropolitan (Non-MSA) Motor Vehicle Fatality Rates—1986, and Impact of 30 Percent Reduction in Non-MSA Deaths on Achieving the National 1990 Objective for Injury Prevention (Motor Vehicle Fatality Rate of 18 per 100,000 population)

	1986 U.S. population (in 1,000s)	1986 Motor vehicle accident deaths	1986 Motor vehicle accident death rates (per 100,000)	Motor vehicle accident death rates if 30% reduction in non-metro MVA deaths
U.S. total	241,036	47,865	19.9	17.9
Metropolitan	184,713	31,867	17.3	17.3
Non-metropolitan	56,323	15,998	28.4	19.9

SOURCES: U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States: 1988*, 108 edition (Washington, DC: U.S. Government Printing Office, 1987); Department of Health and Human Services, Public Health Service, "Vital Statistics of the U.S.: 1986," vol. 2, *Mortality*, Pub. No. 88-1114 (Washington, DC: U.S. Government Printing Office, 1988).

Chapter 4
EMS in a Rural Context

Several factors may adversely affect the delivery of emergency medical services (EMS) in rural areas. This section first describes how the changing rural health care environment affects the delivery of emergency medical services. Second, problems in providing rural emergency medical services are described as are interventions that may help to overcome them.

THE CHANGING RURAL HEALTH CARE ENVIRONMENT

In some rural areas, a decline in the economy has occurred at the same time as major changes in the U.S. health care system. These changes include how health care is paid for (e.g., implementation of prospective hospital payment in the Medicare program) and how health care is delivered (e.g., a shift to outpatient services). Making adjustments to the new national health care environment is difficult for many rural health care systems because they are small and lack diversification. Many rural hospitals that have not diversified and made other transitional changes are now financially vulnerable. Since 1981, nearly 550 rural hospitals have closed (61). In some cases, hospital closures do not adversely affect access to care and are appropriate (e.g., when a small community has more than one hospital and services are duplicated). However, in communities with only a single hospital, hospital closure means that access to hospital-based care is lost and ready access to emergency care is diminished.[1]

Health care is inaccessible in some rural areas because of shortages of health care personnel. Six percent of rural counties (142 of 2,393 nonmetropolitan counties) have no physicians (111) and approximately one-quarter of rural residents live in areas that are federally designated health manpower shortage areas (HMSAs).[2] Many rural areas have difficulty recruiting and retaining physicians, nurses, and other health care personnel because of the heavy demands of rural practice (e.g., longer hours, no backup) or because there is no hospital or other resources that attract providers (111). In some areas, personnel shortages have been exacerbated by diminished support from Federal programs such as the National Health Service Corps (111). Furthermore, rural areas have been adversely affected by the increased cost of medical liability insurance coverage, especially for physicians providing obstetric care (28).

RURAL HEALTH CARE SYSTEMS

Access to well-trained personnel, essential equipment, and facilities in rural communities without a local hospital or physician may sometimes be achieved through cooperation with neighboring communities with medical resources. As the availability of health care services diminishes in rural areas, EMS providers may be left assuming new responsibilities. There may be an increased demand for nonemergency transportation to hospitals and demand for urgent primary care services (e.g., delivering babies). Anecdotal evidence suggests that when a community hospital closes, the local EMS system has a higher number of calls that are nonemergent in nature (103) and there are delays in EMS response times (134). In these communities, the EMS system may need to reorient to provide some urgent care or to coordinate with local providers to make such care available. Rural EMS providers are having difficulty providing EMS services even without these additional pressures. Problems in public access to EMS, prehospital care, and medical response are described in the next section, as are some potential solutions to these problems.

Public Access to EMS Systems

Sparse population, large, remote, or inaccessible service areas, poor weather and road conditions, and limited access to communications may delay detection and reporting of a need for emergency care. An automobile accident occurring along an infrequently traveled rural road may not be detected for hours. When such an accident is detected, access to the EMS system may be further delayed because phones or other forms of communication are not available. Installation of emergency call boxes along major rural highways, and use of automobile cellular phones[3]

[2]HMSAs are counties, parts of counties, or specific facilities with one or fewer physicians per 3,000 or 3,500 population (45 FR 75996).

[3]Reliable cellular telephone networks are not yet widely available (136).

[4]The two States with statewide 911 coverage are Delaware and Maryland (105).

and citizen band radios, could improve public access in the case of motor vehicle crashes (64,82).

A coordinated communications system that includes a widely recognized method to call for help, such as telephoning 911, facilitates a quick and appropriate EMS response. Trained dispatchers can elicit information about the event and can quickly marshal needed resources. Appropriately trained dispatchers can also tell the caller what to do until trained EMS personnel arrive (129). When there is more than one EMS number in a community, confusion over what number to call may result in response delays. As many as 85 emergency numbers were listed in the Greenville, North Carolina phone book, covering 17 exchanges (52). Several EMS agencies in north-central Florida report that some residents in their service areas have to use long-distance to call them by telephone (75).

Universal access to emergency care via 911 has been mandated in 14 States, but statewide 911 access to EMS services is actually available in only two States (table 4-1) (105).[4] Twenty-nine other States are at least half-covered by 911 access (table 4-1) (105). About two-thirds of States report having a statewide plan available for EMS communications (table 4-1).

Many rural areas lack central access and dispatch systems and those with such systems often have old equipment that needs to be replaced and upgraded (82). Furthermore, there is variability in the quality of EMS dispatching that could be improved by agreeing on dispatch standards or protocols and by implementing dispatcher training programs (82). Only six States report that they certify EMS dispatchers or telecommunicators (104).[5]

Access delays may also occur when the public does not know how to contact the local EMS system. Public education can be effective in improving EMS-related knowledge. Nebraska's EMS public information program, for example, appears to have been successful in educating the public on how to access the EMS system and how to provide some basic emergency care. According to a statewide survey, as many as 83 percent of adults knew the telephone number of the ambulance/rescue service, over half of the adults had taken first-aid courses, and 37 percent had completed CPR training. In addition, virtually all of the secondary schools were teaching CPR (30). Many States, however, lack adequate EMS public education. A 1987 survey indicated that four State EMS organizations had no involvement in public education efforts.[6] In the remaining 47 jurisdictions that did have a public education effort, 20 self-evaluated their public education programs as minimally effective, 23 considered their programs moderately effective, and only 4 States rated their educational programs as highly effective (106).[7]

EMS response time, the time elapsed from notification of an emergency to EMS arrival at the scene, tends to be longer in rural than urban areas. In the case of motor vehicle fatalities, the average response time for rural areas (as defined by DOT) is almost twice that of urban areas (11 v. 6 minutes) (123).[8] In many cases, the critical "golden hour" is exceeded because of delays in detection and EMS response time.

Response times can be reduced if an EMS communication system is in place and emergency vehicles can be dispatched from the field (e.g., redirected when returning from another call). EMS communications are hampered in many rural areas by radio "dead spots" that occur because of the limited range of radio signals or because of geographic barriers. Available radio frequencies allow communication between a central base station and an ambulance (or other receiver in the field) that are 20 to 30 miles apart. To reach beyond these ranges, mechanisms to repeat or relay the signal must be used (129).

Thirty-one States reported that some rural areas of their State lacked EMS radio system coverage (82). Communications equipment such as VHF and UHF relays, radio-telephone switching systems, microwave relay, and cellular telephones[9] can overcome

[4]The two States with statewide 911 coverage are Delaware and Maryland (105).

[5]Twenty-four States and the District of Columbia reported that they did not certify EMS dispatchers or telecommunicators. Information was unavailable on dispatch certification from the remaining 20 States (104).

[6]The four States with no EMS organization involvement in EMS public education were Arizona, Delaware, Louisiana, and South Dakota.

[7]The four States that rated their programs as highly effective were Indiana, Montana, New Mexico, and Pennsylvania (106).

[8]Reporting of on-scene arrival times is incomplete. These data are limited to the 37 States that reported fatal crash scene response times 80 percent of the time or more in 1987 (123).

[9]In the future, mobile satellites may be used to improve rural EMS communications (82).

Table 4-1—State EMS Communications, 1986-87

State	Statewide plan available for EMS communications system	Legislation mandating 911	Authority for 911	Percent of population with access to EMS service		
				911	7-digit number	Multiple numbers
Alabama	Yes	No	Local	60	40	0
Alaska	No	No	Local	85	10	5
Arizona	Yes	Yes	State	90	NA	NA
Arkansas	Yes	No	Local	10	70	0
California	Yes	Yes	Local	90	NA	NA
Colorado	Yes	No	Local	80	0	20
Connecticut	NA	Yes	State	65	35	0
Delaware	Yes	No	Local	100	NA	NA
District of Columbia	No	Yes	State	10	NA	NA
Florida	Yes	No	State	89	NA	NA
Georgia	Yes	No	Local	60	100	NA
Hawaii	Yes	No	Regional	95	5	0
Idaho	NA	No	Local	50	45	5
Illinois	NA	No	Local	50	45	5
Indiana	NA	No	Local	40	45	5
Iowa	Yes	No	Local	NA	NA	NA
Kansas	Yes	No	Local	70	30	0
Kentucky	NA	Yes	State	33	10	57
Louisiana	NA	No	Local	NA	NA	NA
Maine	NA	No	Regional	50	50	0
Maryland	Yes	Yes	State	100	NA	NA
Massachusetts	Yes	No	Local	39	0	61
Michigan	NA	Yes	State	45	NA	NA
Minnesota	NA	Yes	Local	90	10	0
Mississippi	Yes	No	Local	50	50	0
Missouri	Yes	No	Local	65	35	0
Montana	NA	No	State	NA	NA	NA
Nebraska	Yes	No	State	90	0	10
Nevada	Yes	No	Regional	80	10	10
New Hampshire	Yes	No	Local	30	5	65
New Jersey	Yes	No	Local[a]	27	0	73
New Mexico	Yes	No	Local	70	15	15
New York	Yes	No	Local	65	10	25
North Carolina	Yes	No	Local	31	55	14
North Dakota	NA	No	Local	32	68	0
Ohio	NA	Yes	NA	30	70	0
Oklahoma	Yes	Yes	Local	7	93	0
Oregon	Yes	Yes	State	90	5	5
Pennsylvania	Yes	No	Local	45	40	15
Rhode Island	Yes	Yes	State	NA	NA	NA
South Carolina	Yes	No	Local	35	30	35
South Dakota	Yes	No	NA	60	25	15
Tennessee	Yes	No	Local	50	30	20
Texas	Yes	Yes	State	20	60	20
Utah	No	No	Local	80	10	10
Vermont	Yes	No	Local	15	85	0
Virginia	NA	No	Local	79	16	5
Washington	Yes	No	Local	80	20	NA
West Virginia	Yes	No	Local	15	25	50
Wisconsin	Yes	No	Local	41	30	29
Wyoming	NA	No	Local	90	4	6

[a]Legislation pending.
ABBREVIATIONS: NA = information not available.

SOURCE: The National EMS Clearinghouse, "State EMS Office: Communications Programs and Disaster Preparedness," The Council of State Governments, Iron Works Pike, Lexington, KY, 1988.

these dead spots but are often too expensive for rural communities (82). In addition to equipment costs, there are training and maintenance costs associated with the systems (82).

Radio frequency congestion is hampering EMS communications in many areas. The congestion occurs because many public safety services (e.g., police, fire, local government, highway maintenance, and forestry conservation) share radio spectra. A special emergency radio service spectrum exists, but it is crowded with unrelated and nonemergency medical licensees. In 1987, 40 States reported having EMS radio communication interference problems (105). The National Association of State and Emergency Medical Services Directors has recommended that the Federal Communications Commission (FCC) establish a new radio service dedicated to EMS communications (71). Rural EMS communications-related problems and potential solutions presented at the March, 1989 "National Rural EMS Needs Workshop" sponsored by the National Rural Health Association, are summarized in box 4-A.

Prehospital Care

Prehospital care includes all care provided to an emergency patient prior to arriving at a hospital. The care may be provided by any of a number of different types of providers, ranging from accident bystanders trained in first aid or CPR to highly trained emergency medical technicians (EMTs). Fire and

Box 4-A—Rural EMS Communications: Problems and Potential Solutions as Presented at the "National Rural EMS Needs Workshop," March, 1989

Problems	Solutions
• Public access to EMS services is hampered by poor communications systems.	• Develop central access/dispatch systems (e.g., 911). • Install emergency call boxes along major rural highways.
• The public is uninformed about accessing the EMS system.	• Institute public education campaigns.
• Many rural EMS communications systems are old and outdated.	• Improve and upgrade EMS radio communications systems.
• Rural areas have many radio "dead spots."	• Expand coverage to wider areas through VHF and UHF relays, microwave relay, radio-telephone switching systems, and cellular telephones. Investigate use of mobile satellites.
• EMS radio frequencies are congested in some rural areas.	• Federal Communications Commission (FCC) should designate additional exclusive VHF and UHF frequencies for EMS.
• EMS communication are not always planned and coordinated with other emergency services.	• Coordinate EMS services with local hospitals, FCC-designated frequency coordinators, disaster response, public service agencies, and local, regional, and State EMS planning agencies.
• EMS communications vary in quality by State and area.	• Develop consensus standards for EMS communications equipment, radio frequencies, and dispatch centers. Establish standardized EMS communications protocols in each area or region under physician medical control and direction. • Provide technical assistance and training to upgrade quality. • Provide quality assurance programs for EMS communications operations.
• What EMS communication systems are most suited to certain rural environments is unknown.	• Conduct research on the cost-effectiveness of different types of EMS communications systems.

SOURCE: National Rural Health Association, "National Rural EMS Needs Workshop," March, 1989, proceedings published in *JEMS*, June 1989. Sponsored by the National Rural Health Association.

police department personnel may provide prehospital care in addition to other services, such as extricating victims of motor vehicle crashes and controlling or preventing fires at the scene of an incident. Prehospital care may be provided at the scene of the emergency and while in transit to a hospital or trauma center. Among the factors that effect the quality of prehospital care are:

- the training of those administering care;
- the availability of transportation and of medical equipment during transport;
- communications between prehospital providers and hospital-based providers; and
- the existence of protocols for the type of medical assistance offered and the transfer of patients to an appropriate level of care.

Prehospital Care Providers

First Responders—When EMS response times are long because of an area's remoteness, road conditions, or lack of EMS resources, community members can be trained as "first responders" to deliver basic EMS care. First responders administer first aid, cardiopulmonary resuscitation (CPR) or other interventions until the ambulance (or aircraft) arrives at the scene. (See box 4-B—description of prehospital care providers and their level of training) (104). At least 42 States and the District of Columbia officially recognize first responders as providers of emergency medical services (104).

Nationwide, over 100,000 first responders have been trained and certified (see table 4-2) (104), but States have used different models to deliver this care. Some first responder programs rely on police, fire, or medical personnel within the community, while others rely on trained community volunteers. In some areas of rural Vermont, for example, "off-duty" rescue personnel (known as "jump crews") can be summoned to an emergency via two-way portable radios from their home or other remote location to provide basic and intermediate life support until an ambulance arrives (51). Here, the first responders are highly trained and experienced. However, it may be difficult to find volunteers that have time for both first response and ambulance duties. In Idaho, quick response units (QRU) made up of trained volunteers have been organized throughout the State to offer basic life-support level service (7). First responders have been used to provide advanced first aid and emergency care in rural Georgian communities that lack both a resident physician and an ambulance service. Their response times of 4 to 5 minutes compared favorably to the average ambulance response time of 20 minutes (69). Publications and courses are available for farm families and workers that provide emergency procedure instructions for bystanders of farm accidents (67).

Emergency Medical Technicians—Ambulance crews staffed by emergency medical technicians (EMTs) offer most prehospital care. In urban areas the EMTs are usually paid, while in rural areas approximately three-quarters of rural prehospital EMS providers are volunteers (7). In some "frontier" States characterized by sparse population settlement (e.g., Idaho), about 90 percent of EMS prehospital personnel are volunteers (7). Without volunteers, many rural communities would be unable to support an EMS system. Some rural counties have no trained EMT providers. These communities rely on providers whose training is limited to first aid (45).

In general, rural EMS volunteer providers do not have as high a level of training as urban providers. (See box 4-B for a description of the types of prehospital care providers and their level of training.) Most rural EMTs are "Basic EMTs" and can provide noninvasive procedures such as first aid, maintaining an adequate airway, administering oxygen, and CPR. In some States, Basic EMTs are permitted to perform more advanced skills such as maintaining intravenous (IV) lines. An average of 134 hours of training are required to become a basic-level EMT (104). A basic EMT may acquire additional specialized training to treat patients with cardiac arrest due to ventricular fibrillation, with defibrillators. (See ch. 5 for a more complete discussion of emergency cardiac care.)

Paramedics have the basic skills of an EMT but are also trained in Advanced Life Support (ALS). ALS-trained paramedics can start IV lines, give medications, and intubate a patient whose upper airway is blocked (see box 4-B, responsibilities of EMS personnel). Paramedic training usually involves about 750 hours (104). More than two-thirds of States certify an intermediate level EMT (sometimes called intermediate EMT or EMT-II).[10] Their

[10]Thirty-eight States and the District of Columbia recognize intermediate level EMTs (104).

Box 4-B—Prehospital Providers

First Responders

First Responders are persons trained to provide initial care for patients suffering injury or sudden illness until EMS providers arrive. Trained First Responders can assess patients, provide basic life support, and render care that is necessary to prevent medical and injury-related problems from becoming a threat to survival. First Responders are trained to provide care using only a minimum of equipment and generally do not transport patients. On average, first responder training involves 44 hours (104).

Emergency Medical Technicians (EMTs)

Emergency Medical Technician—Basic

EMTs provide emergency medical care, and stabilize and transport patients expeditiously to the hospital. They use supplies and equipment normally carried in an ambulance. The typical EMT-basic is trained using the DOT National Standard Curriculum for Emergency Medical Technicians-Ambulance (114 hours). Basic EMT responsibilities include:

- assessing a patient's condition;
- maintaining an adequate airway;
- administering oxygen;
- performing cardiopulmonary resuscitation (CPR);
- hemorrhage control;
- immobilization of fractures and dislocations; and
- basic rescue-extrication techniques.

Basic EMTs may also acquire additional skills such as use of the automatic or manual external defibrillator and become certified as an EMT-Defibrillators or EMT-Ds. On average, acquiring defibrillation skills involves 18 hours (104).

Emergency Medical Technician-Intermediate

The EMT-Intermediate has acquired certain advanced skills in addition to the EMT-Basic skills, which permit the EMT-Intermediate to initiate and continue emergency medical care under the direction of a physician, including the recognition of medical problems and initiation of appropriate invasive and noninvasive therapy (i.e., IV lines, limited medications). Many EMT-Intermediates are trained using the DOT National Standard Curriculum (40-55 hours of classroom) but there is much variation in the scope of practice of these providers from State to State.

Emergency Medical Technician-Paramedic

The EMT-Paramedic has acquired extensive skills in advanced life support (ALS) to provide prehospital emergency care working under both written and/or verbal standing orders of physicians. Most EMT-Paramedics are trained using the DOT National Standard Curriculum (700-1000 hours) but there is much variation in the number of hours required to complete the course.

Advanced Life Support (ALS) Skills Include:

- IV therapy including peripheral and central venous lines;
- cardiac care including monitoring, manual defibrillation, and advanced pharmacology; and
- advanced airway management including intubation.

SOURCE: DOT, NHTSA, John Chew, 1989.

Basic-level skills are augmented with some ALS-level skills (68).

EMTs and paramedics are certified to practice by States, or by regions within States. EMTs practicing advanced life support skills must work under the license of a physician (i.e., they cannot work independently).[11] Although there are standardized EMT and paramedic curricula,[12] there are about 36 different types of EMTs practicing throughout the

[11] An exception to this is Wisconsin, where basic EMTs and paramedics are licensed (104).

[12] The National Standard Curriculum has been developed and is published by the Department of Transportation, National Highway Traffic Safety Administration. There are seven standard curricula for the following EMS professionals: Dispatcher; emergency vehicle operator; EMT-Ambulance; EMT-Intermediate; EMT-Paramedic; EMS Instructor; Air Medical Crew (24).

United States (97).[13] If number of hours in training is an indicator of level of skills acquired in training, there are dramatic differences in skill levels. The number of training hours required of basic EMTs ranges from 104 in California to 315 in Hawaii. Paramedics are trained in 185 hours in Pennsylvania and 2,278 hours in Vermont (Vermont requires a 6-month internship) (104). Despite the variation in hours of training required by States, most training programs adhere to the National Standard Curricula and meet or exceed established behavioral objectives (24).

Certification requirements for volunteer EMS providers vary by State. Alabama, for example, exempts its EMS volunteers from certification (90). EMT certification requirements may even vary within a State. In California the regulatory authority for EMTs rests with local government, so requirements may vary by county. Some States will certify EMTs who are certified by other States or registered with the National Registry of EMTs.[14] EMTs need to be periodically recertified, usually every 2 to 3 years (104).

In many rural areas the pool of potential EMS volunteers is reported to be getting smaller as economic conditions have made it more difficult for rural residents to have the spare time required for volunteer activities (112). It may be especially hard to get volunteers for daytime shifts (60). The availability of prehospital providers varies by State. Alabama has less than 1 EMT per 10,000 population, while South Dakota has nearly 5 per 10,000 (see table 4-2) (104). Nationally, there is a shortage of trained paramedics, and ambulance services in rural areas often cannot afford to hire those that are available (39). The availability of paramedics also varies markedly by State; Mississippi has less than one paramedic per 100,000 population while Florida has nearly 5 paramedics per 100,000 residents (see table 4-2) (104).

Potential disincentives to become trained as an EMT include the costs of initial training and recertification, inaccessibility of training, concerns regarding liability, and fear of contracting contagious diseases such as AIDS. The problem of providing volunteer EMT training in rural areas may be alleviated with mobile EMT courses, correspondence courses, or courses adapted to VCRs for home use. Despite evidence of prehospital personnel shortages, few States provide financial assistance to train prehospital providers. According to a 1986 survey, only three States financially support their first responder trainees, 12 States support EMT trainees, and 5 States support paramedic trainees (104).[15]

The relatively small populations that characterize rural areas mean a low volume of emergency cases. In the face of low volumes, it is difficult for the rural prehospital providers, especially those trained at the paramedic level, to maintain their skills. Rural EMS providers could maintain and improve skills through additional inservice training, locating EMTs and paramedics in local emergency rooms,[16] periodic case critiques by medical advisers, and training EMTs in such intermediate skills as advanced airway management, IV therapy, and/or defibrillation (i.e., upgrade the basic EMT to the Intermediate-level EMT).

An example of an innovative continuing education training program adapted to the needs of rural providers is the Idaho EMS Mobile Trauma Training Unit. Rural EMTs have an opportunity to maintain or upgrade skills through training programs that emphasize application of practical skills. In 1984, the mobile unit made training available to 150 rural communities throughout Idaho, providing trauma skills training for about 2,000 EMTs (10).

Idaho has also offered continuing education programs to EMS personnel throughout the State via a "telelecture" program. Through teleconferencing, lectures by EMS experts have been "attended" simultaneously by as many as 1,000 EMS personnel in 71 classrooms widely dispersed throughout the State (9). The system operates at relatively low cost but is dependent on a sophisticated statewide communication system, which includes mountaintop stations connected by microwave links to regional hospitals and to the Idaho Statewide EMS

[13]Much of the variation in types of EMTs occurs because States have adopted very different standards for intermediate-level EMTs.

[14]Twenty five States and the District of Columbia use the National Registry of EMTs' examination as the basis of certification. An additional six States accept National Registry examinations in lieu of their State examinations. State policies dictate the ability to obtain cross-State certification. The National Registry of EMTs facilitates cross-State certification (110).

[15]Forty-seven States responded to the survey.

[16]Oregon has implemented a grant-funded, week-long urban "externship" program for rural EMTs (137).

Table 4-2—Currently Certified Prehospital Providers by State, 1986-87

State	1986 total population (in 1,000s)	Number of certified prehospital providers[a]						Prehospital provider (per 10,000) ratio to population		
		First responder	EMT	EMT-D	EMT-I	EMT-CC	Paramedic	First responder	EMT	Paramedic
U.S.	24,1078	114,093[b]	363,691[c]	5,254[d]	17,733[e]	9,894[f]	41,295[g]	0.47	1.51	0.17
Alabama	4,052	NR	3,000	NR	1,215	NR	1,607	NA	0.74	0.40
Alaska	534	NA	2,100	NA	500	250	100	NA	3.93	0.19
Arizona	3,319	NR	NA	NR	NA	NR	NA	NA	NA	NA
Arkansas	2,372	NR	3,672	NR	25	NR	243	NA	1.55	0.10
California	26,981	NR	27,375	NR	NR	600	3,750	NA	1.01	0.14
Colorado	3,267	NA	10,141	NR	NR	236	717	NA	3.10	0.22
Connecticut	3,189	5,000	9,800	NA	800	NR	570	1.57	3.07	0.18
Delaware	633	1,200	100	NR	NR	NR	NR	1.90	0.16	NA
D.C.	626	NA	575	NR	37	NR	49	NA	0.92	0.08
Florida	11,675	NA	21,473	NR	NR	NR	5,567	NA	1.84	0.48
Georgia	6,104	NR	4,000	NR	NR	732	1,592	NA	0.66	0.26
Hawaii	1,062	NA	310	NR	NR	NR	180	NA	0.29	0.17
Idaho	1,002	NA	NA	NA	NA	NR	NA	NA	NA	NA
Illinois	11,552	NA	15,822	NR	837	NR	4,325	NA	1.37	0.37
Indiana	5,504	3,000	10,200	NR	240	NR	749	0.55	1.85	0.14
Iowa	2,851	4,574	5,816	1,244	811	NR	658	1.60	2.04	0.23
Kansas	2,460	NR	5,438	NA	98	NR	522	NA	2.21	0.21
Kentucky	3,729	NR	8,000	NR	NR	NR	NA	NA	2.15	NA
Louisiana	4,501	NA	NA	NR	NA	NR	NR	NA	NA	NA
Maine	1,173	NA	NA	NR	NA	NA	NA	NA	NA	NA
Maryland	4,463	8,000	12,000	NR	NR	1,800	350	1.79	2.69	0.08
Massachusetts	5,832	50,000	11,500	150	300	NR	600	8.57	1.97	0.10
Michigan	9,145	NA	7,000	NR	600	NR	1,600	NA	0.77	0.17
Minnesota	4,214	16,360	13,007	NR	171	NR	966	3.88	3.09	0.23
Mississippi	2,625	NR	1,500	NR	124	NR	88	NA	0.57	0.03
Missouri	5,066	NA	4,862	NR	NR	NR	1,600	NA	0.96	0.32
Montana	819	1,400	2,000	200	NA	NR	NA	1.71	2.44	NA

Table 4-2—Currently Certified Prehospital Providers by State, 1986-87—Continued

State	1986 total population (in 1,000s)	Number of certified prehospital providers[a]						Prehospital provider (per 10,000) ratio to population		
		First responder	EMT	EMT-D	EMT-I	EMT-CC	Paramedic	First responder	EMT	Paramedic
Nebraska	1,598	NA	7,500	NA	NA	NA	NA	NA	4.69	NA
Nevada	963	NA	NA	NA	NA	NR	NA	NA	NA	NA
New Hampshire	1,027	1,200	18,000	750	300	NR	140	1.17	17.53	0.14
New Jersey	7,619	NA	9,200	NR	NA	NR	1,112	NA	1.21	0.15
New Mexico	1,479	500	2,600	NA	360	NR	240	0.34	1.76	0.16
New York	17,772	NA	27,940	NA	2,026	2,554	1,385	NA	1.57	0.08
North Carolina	6,333	NA	14,742	114	1,424	256	985	NA	2.33	0.16
North Dakota	679	298	1,776	143	29	NR	41	0.44	2.62	0.06
Ohio	10,752	NA	NA	NR	NA	NR	NA	NA	NA	NA
Oklahoma	3,305	NA	2,310	150	300	NA	225	NA	0.70	0.07
Oregon	2,698	2,600	4,202	350	1,300	400	680	0.96	1.56	0.25
Pennsylvania	11,888	3,243	23,199	NR	NR	1,704	2,868	0.27	1.95	0.24
Rhode Island	975	NA	1,300	110	520	490	12	NA	1.33	0.01
South Carolina	3,377	NA	3,160	NR	227	NR	853	NA	0.94	0.25
South Dakota	708	NA	3,500	NR	7	NA	61	NA	4.94	0.09
Tennessee	4,803	2,400	6,078	NA	NA	NA	695	0.50	1.27	0.14
Texas	16,685	9,857	19,230	NR	1,316	NR	4,466	0.59	1.15	0.27
Utah	1,665	NR	3,818	100	1,718	NR	276	NA	2.29	0.17
Vermont	541	NA	1,225	1,229	383	NA	28	NA	2.26	0.05
Virginia	5,787	NA	NA	NR	NA	NA	NA	NA	NA	NA
Washington	4,462	1,261	8,848	404	NR	NR	665	0.28	1.98	0.15
West Virginia	1,918	NA	9,872	NR	765	872	175	NA	5.15	0.09
Wisconsin	4,785	2,500	13,400	250	650	NR	525	0.52	2.80	0.11
Wyoming	507	700	2,100	60	650	NR	30	1.38	4.14	0.06

Note: NA =indicates information not available.
NR =provider category not recognized/certified by State.

[a]Prehospital providers can hold more than one certification in some States (e.g., certified as a paramedic an an EMT) and therefore the total number of prehospital providers by State cannot be determined from this table.
[b]*First responders*—eight States do not recognize first responders. An additional 25 States do, but did not provide information.
[c]*EMT*—all States recognize EMTs. Seven States did not provide information.
[d]*EMT-D*—28 States do not recognize EMT-Ds. An additional 9 States do, but did not provide information.
[e]*EMT-I*—11 States do not recognize EMT-Is. An additional 11 States do, but did not provide information.
[f]*EMT-CC*—33 States do not recognize EMT-CCs. An additional 7 States do, but did not provide information.
[g]*Paramedic*—2 States do not recognize paramedics. An additional 9 States do, but did not provide information.

SOURCE: National EMS Clearinghouse, "Training and Certification of EMS Personnel," January 1989.

Communications Center (8). At the present time, few other States are using teleconferencing or computers for training.[17]

Given the time and cost of training, it is important to retain as many volunteer EMTs as possible. There is little information, however, about how long volunteers remain in service. In West Virginia, where volunteer EMTs have to be recertified at least every 2 years, the average stay for an EMT is a little over 2½ years (90). In Colorado, 15 percent of EMTs do not become recertified. Surveys of volunteer prehospital care providers suggest that among the most important factors that lead them to leave EMS service are: economic conditions in rural areas; fear of personal risk; and costs associated with volunteer work (62). Professionalization of volunteer EMS services and management training may resolve some other factors that lead volunteers to drop out, namely interpersonal conflicts, and the stress and burnout associated with EMS work (112).

Providing workers' compensation for duty-related injuries and protection from liability might help retain experienced rural EMS volunteer providers. New York provides compensation coverage for almost 400 volunteer squads, following passage of the Volunteer Ambulance Benefit Law (90).[18] Volunteer fire fighters and EMTs would receive a tax credit of $100 dollars under a Wisconsin bill that was recently introduced (Wisconsin, Assembly Bill 2). On the Federal level, the Volunteer Protection Act (H.R. 911), currently under consideration by Congress, encourages States to grant certain volunteers (such as those volunteering for nonprofit EMS departments) immunity from personal civil liability. Box 4-C summarized some of the problems related to maintaining qualified prehospital care providers in rural areas identified at the March 1989 National Rural EMS Needs Workshop.

Transportation

EMS transport may be difficult in rural areas because of small, widely dispersed populations, geographic barriers, and inclement weather. As definitive care is often located in distant cities, one approach to decreasing time to definitive care is to improve the rural EMS transportation system. Rural transport may be improved through better organization of existing ground-based resources and by using air medical transport services.

Ground Transportation

Nationally, there are over 12,000 ambulance services with nearly 35,000 ambulances (108). Most States have developed regulations and standards for the design of ambulance vehicles and equipment used by EMS personnel, and for various EMS services and personnel (108). Emergency vehicles may be classified as Basic Life Support (BLS), Advanced Life Support (ALS), or Mobile Intensive Care Units (MICU), depending on their equipment and staffing. The proportion of ambulance services staffed by basic EMTs, intermediate EMTs, or paramedics varies by State. In North Dakota, for example, only 3 of 130 ambulance services are staffed by paramedics. In contrast, more than one-half of ambulance services in Florida, Missouri, and West Virginia are staffed by paramedics (108).

Rural areas with no EMS prehospital system, or independent but under-utilized systems, may consider linkage models to provide or improve services. Smaller population centers can be grouped into EMS service areas and share resources. Recognizing that complete ALS-level ambulance service coverage was neither practical nor financially feasible in rural northeast Missouri, EMS planners developed a "nodal" concept of EMS. As shown in figure 4-1, BLS and ALS ambulance services are evenly distributed throughout the region to promote access to ALS care and to achieve an ambulance response time of 30 minutes or less. Most of the region is within 15 to 20 miles of EMS service, but ALS response times will likely exceed 30 minutes in some areas within the region (39).

Air Medical Tranport

Rural areas that lack roads or are far from hospitals are especially dependent on air medical transport services when medical emergencies occur. There are currently over 200 U.S. air medical programs that transport approximately 140,000 pa-

[17]Only Massachusetts, Rhode Island, South Carolina, and Wisconsin report using teleconferencing as part of the training process. Maryland and South Carolina report using computers for training (104).

[18]Volunteer firefighters already had compensation coverage.

Box 4-C—EMS Prehospital Personnel: Problems and Potential Solutions as Presented at the "National Rural EMS Needs Workshop," March 1989

Problems	Solutions
• There are shortages of volunteer EMS providers in rural areas.	• Outreach to high school groups, the elderly, ethnic minorities and other groups traditionally not involved as EMS volunteers. • Make EMS training more accessible to rural residents by using alternative instructional modes such as videotapes and correspondence courses. • Assure the availability of instructors in rural areas by recruiting and training rural practitioners as trainers. Alleviate financial burdens of becoming an EMS volunteer by providing tax credits, training scholarships, or liability insurance.
• The level of training of rural prehospital providers is substantially below that of urban providers.	• Provide financial incentives for rural EMS providers to upgrade their skills in the form of training scholarships, and tax breaks. • Develop programs to allow rural prehospital providers to maintain skills through such devices as accident simulation.
• The EMS standard training curricula does not always reflect the needs of rural areas.	• Conduct research to determine the knowledge required to carry out EMS field operations. • Provide specialty courses suited to the needs of the rural provider (e.g., farm rescue).
• Rural EMS providers frequently lack guidance from physicians.	• Designate responsibility for medical control. Provide physicians charged with medical control responsibilities appropriate training and orientation. Develop medical control consensus standards.

SOURCE: National Rural Health Association, "National Rural EMS Needs Workshop," March, 1989, Proceedings Published in *JEMS*, June 1989. Sponsored by the National Rural Health Association.

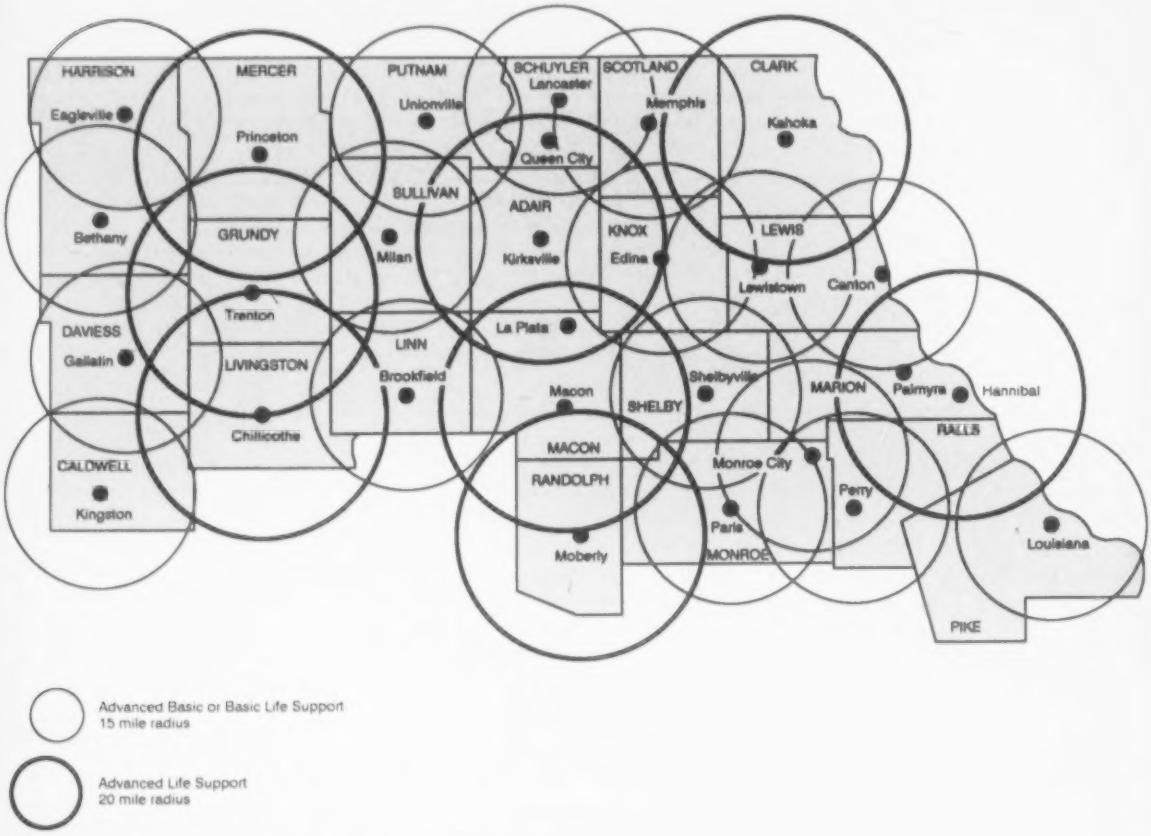
tients a year, but evidence suggests that air medical services are unavailable in many rural areas.

Air medical programs use both fixed-wing aircraft (airplanes) and helicopters. Airplanes or helicopters are used in interhospital transfers of critical patients, such as heart disease patients and newborns requiring intensive care. Helicopters are generally more suitable than airplanes for transporting patients from an accident site to a hospital because of their flexibility in landing at a scene and at a trauma center. Geography and weather conditions such as heavy snow storms may, however, limit the use of helicopters. About 80 percent of helicopter transport services are hospital-based, 10 to 15 percent are offered through public agencies, and the remaining are offered through the military (MAST)[19] or are privately run (29).

Helicopter service augments the ground ambulance program and should be used in instances where time, distance, medical personnel need, or scene isolation warrant it (97). Air medical services are usually based at urban tertiary care hospitals. The service area extends about 150 miles beyond the air medical base which generally includes rural areas. It may, however, take a helicopter as long as 90 minutes to travel 150 miles. Fast airplanes are usually used for longer transports. Sparsely populated States such as Alaska, Texas, Arizona, Montana, and Wyoming rely primarily on airplanes for their EMS transports. In other areas, most EMS air transport is provided by helicopters (97).

[19]MAST stands for Military Assistance to Safety and Traffic. Since 1969, 29 MAST programs have augmented some civilian EMS systems with military helicopters. MAST serves many rural areas (91).

Figure 4-1—A Nodal Concept of EMS for Rural Northeast Missouri



SOURCE: East, S. and Tenbrink, T.D., 1989 (see ref. 39)

Many helicopter-transported patients are trauma patients, but only 15 to 25 percent of helicopter transports emanate from the scene of an accident—most (75 to 85 percent) are interhospital transports (56). Many trauma cases are initially transported by ground ambulance to a community hospital where the patient is resuscitated and stabilized before being transferred to tertiary care via helicopter.

The number of helicopter medical transport services has increased rapidly in the last 20 years following successful experience with helicopter transport during the Vietnam war. The availability of air medical transport, however, varies widely by State (see table 4-3; and figures 4-2 and 4-3). An estimated 20 percent of the population lack air medical coverage, and the greatest voids are in rural areas (97). Maine, Vermont, and New Hampshire lack helicopter transport but have programs that border their States. Some evidence suggests that providers in rural areas delay requesting helicopter transport when it is needed (41).

A few areas in the country may have too much coverage. Missouri, with 2.7 helicopters per million population has 3 times the national average (.9 per million) and health planners have suggested that there be a freeze placed on acquiring new helicopters (65).

In some rural areas, there may be inadequate access to air medical transport services because the low volume and high costs of providing the service are deemed "uneconomical" by privately run air medical services. Sometimes service is inadequate because regionalization is lacking. Several programs

have, however, successfully extended service into rural areas using satellite placement of aircraft. The Missouri Staff for Life program at the University of Missouri, Columbia, for example, has located one of its helicopters at a satellite location 62 miles south of the host facility at a rural level II trauma center. Satellite placement improves access to transport in southern Missouri, where over half of the program's patient volume is generated. Satellite placement was tried in northern Missouri but was not feasible because of relatively low patient volume and a lack of local providers that could staff the helicopter. Northern Missouri is now served by a fast aircraft located in Columbia (97). The Flight for Life Program in Milwaukee, WI has also used a satellite helicopter 50 miles south of the host facility to improve response times in rural areas. Arizona and Illinois have achieved statewide access to air medical services through a merger of public and private air transport services. Here, aircraft are used for both air medical and law enforcement purposes (97).

As helicopter services have proliferated, questions have arisen regarding their costs, appropriate utilization, and safety. Helicopters cost from 1 to 2 million dollars each and operating costs average about $650,000 per year (97).[20] Surface ambulances, in contrast, cost about $75,000 and operating expenses average under $200,000 (97). The average number of patient transports per aircraft is 300-500 patients per year with optimal utilization at 500-700 transports (97). With these costs and necessary volume, small rural communities cannot reasonably acquire their own helicopters. However, in many rural areas, helicopters are the only way to receive needed emergency medical care quickly. Some rural areas have a sufficient volume of cases to be served by private air medical companies. Where volume is insufficient, States could help ensure that services are available to rural areas by encouraging State and private cooperative agreements, by promoting offsite placement of helicopters where feasible, utilizing MAST resources where available, or through subsidies.

Medical Control

The quality of prehospital care may be compromised if "medical control" is not provided. Medical control requires adequate communications systems

Table 4-3—Ratios of Helicopters[a] to Population by State, 1988

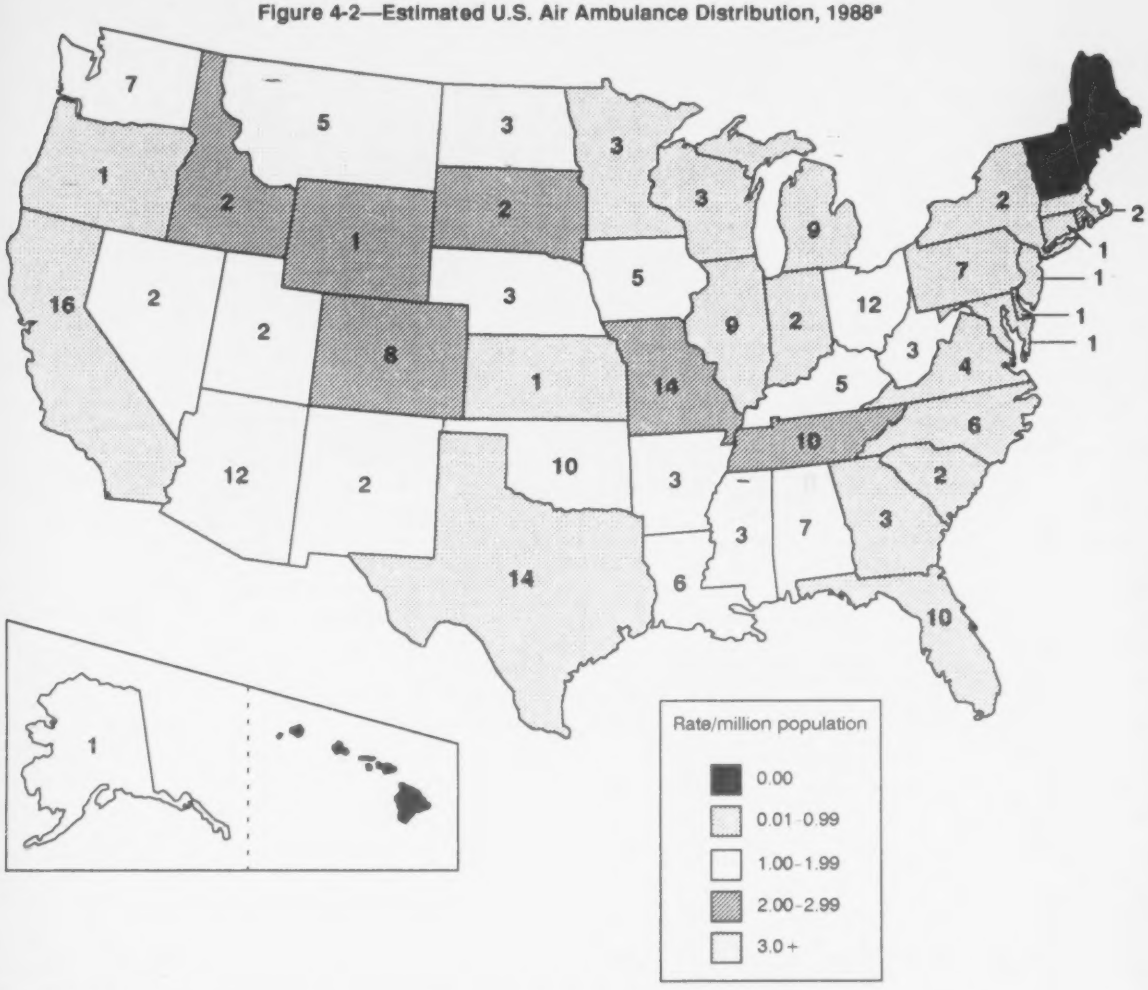
Rank order	State	1987 population	Number of helicopters	Rate/ million
1	Montana	809,000	5	6.18
2	North Dakota	672,000	3	4.46
3	Arizona	3,386,000	12	3.54
4	Oklahoma	3,272,000	10	3.06
5	South Dakota	709,000	2	2.82
6	Missouri	5,103,000	14	2.74
7	Colorado	3,296,000	8	2.43
8	Tennessee	4,855,000	10	2.06
9	Wyoming	490,000	1	2.04
10	Idaho	998,000	2	2.00
11	Nevada	1,007,000	2	1.99
12	Alaska	525,000	1	1.90
13	Nebraska	1,594,000	3	1.88
14	Iowa	2,834,000	5	1.76
15	Alabama	4,083,000	7	1.71
16	D.C.	622,000	1	1.61
17	West Virginia	1,897,000	3	1.58
18	Washington	4,538,000	7	1.54
19	Louisiana	4,461,000	6	1.34
20	Kentucky	3,727,000	5	1.34
21	New Mexico	1,500,000	2	1.33
22	Arkansas	2,388,000	3	1.26
23	Utah	1,680,000	2	1.19
24	Mississippi	2,625,000	3	1.14
25	Ohio	10,784,000	12	1.11
26	Michigan	9,200,000	9	0.98
27	North Carolina	6,413,000	6	0.94
28	Texas	16,789,000	14	0.83
29	Florida	12,023,000	10	0.83
30	Illinois	11,582,000	9	0.78
31	Minnesota	4,246,000	3	0.71
32	Virginia	5,904,000	4	0.68
33	Wisconsin	4,807,000	3	0.62
34	Pennsylvania	11,936,000	7	0.59
35	South Carolina	3,425,000	2	0.58
36	California	27,663,000	16	0.58
37	Georgia	6,222,000	3	0.48
38	Kansas	2,476,000	1	0.40
39	Oregon	2,724,000	1	0.37
40	Indiana	5,531,000	2	0.36
41	Massachusetts	5,855,000	2	0.34
42	Connecticut	3,211,000	1	0.31
43	Maryland	4,535,000	1	0.22
44	New Jersey	7,672,000	1	0.13
45	New York	17,825,000	2	0.11
46	Vermont	548,000	0	0.00
47	Rhode Island	986,000	0	0.00
48	New Hampshire	1,057,000	0	0.00
49	Maine	1,187,000	0	0.00
50	Hawaii	1,083,000	0	0.00
51	Delaware	644,000	0	0.00
	Total:	243,399,000	226	—
	Averages:		4.43	0.93

[a]Number of helicopters is based on Association of Air Medical Services (AAMS), formerly the American Association of Hospital Based Emergency Air Medical Services (ASHBEAMS). Some nonhospital based helicopters (e.g., public safety services) were excluded from these counts.

SOURCE: Missouri Health Facilities Review Committee, "Missouri Air Ambulance Report—1989," January 1989.

[20]Airplane transportation services generally operate at 25 to 40 percent of the cost of helicopter services because most airplane services are not dedicated solely to air medical transportation and operating costs are lower (97).

Figure 4-2—Estimated U.S. Air Ambulance Distribution, 1988[a]



Average of 4.3 Air Ambulance Units per State and an average of 0.93 per million population

[a]Number of helicopters is based on Association of Air Medical Services (AAMS), formerly the American Association of Hospital Based Emergency Air Medical Services (ASHBEAMS). Some nonhospital based helicopters (e.g., public safety services) were excluded from these counts.

SOURCE: The Missouri Health Facilities Review Committee, "Missouri Air Ambulance Report," January 1989.

and commitment from the medical community. It is sometimes difficult to get rural physicians to provide medical guidance in the form of practice guidelines (off-line medical control) and on-scene and transport medical advice via radio (on-line medical control). Many emergency room medical directors in rural hospitals are not EMS specialists and therefore could benefit from training and orientation regarding their medical control responsibilities (82).[21] Consensus standards for medical control may be particularly useful in rural areas.

Prehospital providers may need advice regarding where to take an emergency patient. As the triage decision is often critical to patient survival or death, the highest available level of medical expertise should be brought into the triage decision-making

[21]A training course for physicians on the provision of medical control for EMS is under development by the American College of Emergency Physicians (ACEP) (63).

Figure 4-3—U.S. Helicopter Medevac Programs

Two hundred and thirty-one helicopter ambulance services are run in 46 States and the District of Columbia by hospitals, the military and State and local police and rescue services as of 1987. At least 19 additional programs are scheduled to start by early 1988.
SOURCE: A. Schneider, *Rescue at Risk*, The Pittsburgh Press, 1987.

process. This responsibility is usually assumed by the local emergency department physician (5). Some areas have designated trauma or critical care centers and explicit triage policies (see discussion in ch. 5). In other areas, policies dictate that patients be taken to the nearest hospital. Critical trauma patients may be transported to a trauma center after being stabilized at a local hospital, but in some cases immediate transport to the trauma center is required. It is especially important that medical control be available to prehospital care providers when triage patterns are not explicit.

Fear of litigation may discourage some physicians from providing medical control to the local EMS system. As of 1987, 18 States had enacted legislation that protects physicians from civil liability when they assume EMS medical control responsibilities (109).

Medical Response

Although many of the events precipitating the need for EMS occur at the same rate in urban and rural areas, the level of hospital care required to respond to emergent events is not equally available. Because large numbers of people are concentrated in urban areas, the specialized services required to care for the most acutely ill and injured patients can be maintained. In rural areas, however, emergent events occur infrequently, making it economically difficult to maintain a tertiary-level facility. Furthermore, it is difficult for rural EMS providers to maintain specialized skills when they are infrequently used. When faced with emergencies that require services

beyond those available in the local health care system, rural communities must have a system in place to stabilize and transport patients. Integration of levels of care or a referral systems approach to EMS are, however, nonexistent in many rural areas.

While access to specialized services, such as those available in a trauma center, is central to a good EMS system, local resources must be adequate to handle the majority of EMS cases that do not require these specialized services. Most calls to an EMS system can be appropriately handled at a community hospital. For example, about 90 to 95 percent of trauma cases can be treated adequately at a community hospital (5), while only 5 to 10 percent of cases are critical and require more specialized services. In the evaluation of EMS systems, it is as important to examine the availability of local hospital resources as it is to examine access to more distant specialized resources, such as trauma centers.

When a rural area has a community hospital, it almost always (98 percent) has an emergency room but rarely has a trauma center (see table 4-4).[22] In general, there are few specialized emergency physicians (i.e., Board-certified emergency physicians) and nurses in rural hospitals. Instead, physicians and nurses tend to be generalists who must provide care in all of the various hospital specialty areas. They provide care in the emergency room if and when a patient presents there. These providers may not only lack the specialized training required to appropriately manage emergency patients, but they often do not have the opportunity to frequently practice necessary EMS skills and maintain proficiency (53,63). Making continuing education courses in emergency medicine available to physicians practicing in rural areas could effectively improve the community hospital's EMS medical response and improve the quality of medical control of the community's EMS system.

EMS treatment delays may occur in rural hospitals because rural emergency departments are often not staffed by a physician 24 hours a day. In Idaho, for example, only 9 of the State's 48 hospitals have 24-hour physician coverage (108). Many rural hospitals have trouble paying for 24-hour emergency room physician coverage and opt for rotating, on-call coverage (87).

Emergency room nurses are usually available until the physician arrives, and outcomes of patients with life-threatening emergencies may be improved by upgrading and maintaining their skills (93). A survey of nurses providing emergency room care in rural areas cites understaffing of emergency departments, underqualified nurses and physicians, a lack of continuing education programs, and the absence of statewide emergency standards as among the most serious problems facing rural emergency nurses (37). As of 1986-87, however, only Arizona, Illinois, and the District of Columbia had EMS offices that had set minimum standards for nurse emergency department practice. Furthermore, a 1986-87 State survey showed that few State EMS offices were conducting training programs for nurses (107).[23]

An innovative approach to continuing education for rural EMS providers is the use of computer-based simulation programs similar to those used to instruct pilots. One such program includes a series of EMS patient-management problems designed to help physicians, nurses, and critical care providers sharpen their ability to make clinical decisions (43).

Regionalization

Many States have designated specialized facilities for the treatment of trauma, burn, or other types of emergency patients. Before designating facilities, States usually adopt standards for personnel and equipment that must be met before designation can occur. Some States "verify" facilities that meet the standard while others "designate" facilities that meet the standards according to the State's needs. Under the verification process, as many facilities as meet the standard may be used for specialized services. In contrast, under the designation process, facilities often compete to be designated (108). Facilities have been verified or designated for their trauma care, spinal injury care, poison centers, psychiatric services, burn centers, and cardiac care (108). Some States have triage criteria that specify when patients should bypass a nonspecialized hospital for a specialized one (see ch. 5). The presence of written agreements (sometimes called transfer agree-

[22]Whether or not a hospital has a trauma center depends largely on the number of hospital beds. Nearly one-third of rural hospitals with 200 to 300 beds have a trauma center.

[23]States EMS offices that were offering nurse training (or providing financial assistance for training) include Alaska, Illinois, Maryland, Massachusetts, Nevada, New Jersey, New Mexico, and Rhode Island (107).

Table 4-4—Percent of Community Hospitals With EMS-Related Services In Metropolitan and Nonmetropolitan Hospitals by Bed Size (under 300 beds), 1987[a]

Hospital location and bed size (number of hospitals)	Emergency department		Trauma center		Blood bank	
	Percent	Number	Percent	Number	Percent	Number
Metropolitan:						
6-24 (22)	81.8	(18)	—	(0)	22.7	(5)
25-49 (122)	83.6	(102)	3.3	(4)	52.5	(64)
50-99 (363)	94.8	(344)	5.0	(18)	69.7	(253)
100-199 (693)	96.7	(670)	16.2	(112)	77.8	(539)
200-299 (571)	97.5	(557)	28.2	(161)	84.2	(481)
Total (1,771)	95.5	(1,691)	16.7	(295)	75.8	(1,342)
Nonmetropolitan:						
6-24 (183)	94.5	(173)	0.5	(1)	45.4	(83)
25-49 (753)	97.9	(737)	2.9	(22)	49.8	(375)
50-99 (831)	98.7	(820)	6.5	(54)	66.8	(555)
100-199 (526)	97.7	(514)	16.0	(84)	75.5	(397)
200-299 (132)	97.7	(129)	31.8	(42)	87.1	(115)
Total (2,425)	97.9	(2,373)	8.4	(203)	62.9	(1,525)

[a]Community hospitals are defined as short-stay, non-Federal, nonspecialty hospitals.

SOURCE: OTA analysis of data from The American Hospital Association 1987 Annual Survey of Hospitals.

ments) between facilities providing different levels of care can expedite a rapid patient transfer and may save a rural hospital the cost of upgrading equipment and resources.

Social and Political Constraints on Rural EMS Development

Efforts to upgrade and regionalize rural EMS systems are sometimes impeded by social and political factors. Rural areas are frequently characterized by older, less affluent, and more traditional residents that may be less knowledgeable about the use and efficacy of emergency medical services, and be slower to accept new patterns of health care delivery. Rural residents have been characterized (even by rural residents themselves) as "parochial," "fiercely independent," distrustful of urban initiatives, and leery of control by State or Federal Governments (135).

A rural community's desire for local control and autonomy is oftentimes antithetical to the effort to create coordinated, regional EMS systems. In one New England State, the desire for local autonomy was intense; each community, regardless of size, wanted its own physician, its own ambulance service, and its own hospital (135). This pattern is neither cost-effective nor conducive to the maintenance of skills by the volunteer ambulance attendants. It has led to an excess of vehicles, an enormous EMS training burden because of the large number of volunteers required to staff the service, a multiplicity of dispatch centers, a suboptimal distribution of vehicles, and a complicated coordination task (135). In the mid-1970's, the region received a large grant to establish a central communications center with 911 access for all emergency services. Although the central communications center was established, a 911 access system was not because of opposition from 19 volunteer fire chiefs who wanted to retain dispatch rights. Consequently, a system of central dispatch and 911 access remained elusive goals for this area (135).

Efforts to regionalize services have sometimes failed even when incentives such as free equipment are offered in exchange for cooperation. In one Pacific Northwest rural community, for example, local leaders decided not to request Federal funding to purchase much-needed EMS communications equipment, because they wanted to avoid restrictions attached to Federal funds for EMS even though the town could not afford the equipment.

Some rural communities oppose governmental regulation and intervention in the private sector operation of EMS services and there is often resistance to the passage of mandatory standards for EMS providers, vehicles, and facilities. Sometimes, resistance is simply due to the fact that local resources may be unavailable to upgrade the EMS system to meet new standards. Furthermore, national standards may be viewed as inflexible and not suited to the unique circumstances of rural areas. Without standards, however, there is wide variation in the quality of services available in rural areas. Some

local governments have agreed to subsidize a private ambulance service, but they often have not provided for performance standards, ambulance regulations, contracts, or other needed mechanisms of public accountability for the tax dollars provided (135).

What may appear to outside EMS observers to be a major improvement in the quality of prehospital care may not be perceived as such by local residents. In one small community, for example, the local funeral home (one of the last in the State still in the ambulance business) decided to withdraw from ambulance service provision in the face of increasing financial losses and the possibility of the passage of State ambulance regulations. A pair of experienced paramedics from a nearby metropolitan area took over the service and the town progressed rapidly from an inadequate, antiquated funeral home system to a well-equipped and well-staffed basic life support system with advanced life support capabilities. The public, however, missed the low rates charged by the funeral home (which had provided the service largely for public relations reasons), were unaware of the significant improvement in the quality of care, and did not understand why the paramedics spent so much time at the scene of the EMS incident (to stabilize the patient prior to transport). They much preferred the funeral home service.

One strategy that EMS leaders could use to ameliorate some of the rural constraints on EMS system-building and regionalization is public education regarding the importance of EMS and how EMS systems are organized. EMS leaders, for example, could make presentations at schools, city council meetings, senior citizen groups, civic clubs, and health fairs. They can also educate members of the local media concerning EMS issues, since the media can be an extremely effective means of raising the awareness of the public and elected officials.

The functions of State and regional EMS agencies and councils could be supported as they can serve as a valuable technical resource for rural providers, advising them concerning financial management, liability insurance, and third-party reimbursement; providing training equipment and courses; and seeking out public and private financial assistance. A decentralized structure of county and regional councils may be effective in rural States marked by extreme local independence.

EMS leaders could attempt to capitalize on the competitiveness characteristic of rural towns and ambulance service providers. For example, if EMS leaders can persuade the members of a key volunteer squad of the need for training, and modern equipment and vehicles, their example is likely to pique the competitive spirit in neighboring squads, who may then follow suit. The dedication of rural volunteers is impressive and can be a valuable asset in building and maintaining an EMS system.

While there are examples of communities that have resisted EMS systems development, there are numerous rural communities that have developed model EMS systems.[24] In the rural Texas panhandle, for example, an EMS system has been developed to provide services in a 26 county, 26,000 square-mile area. The Panhandle Emergency Medical Services System (PEMSS) was originally federally funded, but it is now a nonprofit corporation sustained through fees paid by 56 ambulance services located within the region.[25] Membership dues provide for training programs, vehicle and equipment purchases, quality assurance programs, ongoing communications networking, and system evaluation.[26] Hospitals in the region are categorized according to level of care and there are comprehensive prehospital medical and transport protocols. The region has a single regional medical communications network that reaches throughout the Panhandles' vast area (58).

[24]DHHS's Office of Rural Health Policy will complete some rural EMS case studies by early 1990 (32).

[25]The PEMSS members pay $0.17 per individual residing in the member's service area. Fees range from $45 to $36,000 per year (58).

[26]PEMSS is controlled by a board of directors that governs the organization with advisement from a regional advisory committee (58).

Chapter 5

Emergency Cardiac and Trauma Care in Rural Areas

Caring for victims of cardiac arrest and trauma represent two of the most common demands of the emergency medical services (EMS) system. In this section, the care of patients with these conditions is used to illustrate the special problems of delivering EMS services in rural areas.

CARDIAC CARE

Cardiovascular disease is the primary cause of death in the United States, accounting for nearly half of all deaths. More than half of cardiovascular disease deaths are caused by coronary heart disease, and most of these deaths occur suddenly (sudden cardiac arrest), usually outside of hospitals (52).[1] Requests for EMS services are more likely to be related to complications of medical conditions such as heart disease than for trauma. In rural Texas, for example, about one in seven calls for EMS services are attributed to heart complications (see table 3-1). Coronary heart disease death rates are 25 percent higher in rural areas but the fact that the rural population has proportionately more older residents may largely explain this difference (table 5-1).

At present, no more than 5 percent of sudden cardiac arrest victims are successfully resuscitated, but the combination of a well-organized EMS system and the application of a relatively new technology—the automated external defibrillator—could raise the proportion of successful resuscitations[2] to as high as 30 percent (52). Factors that maximize a patients chances of recovering following cardiac arrest relate to time to care and the skills of the prehospital provider. Providing cardiac EMS care quickly is essential but difficult in many rural areas. In the case of cardiac arrest, cardio pulmonary resuscitation (CPR) must begin within 4 minutes and definitive care within 10 minutes of a cardiac arrest (115). Rural EMS systems are at a disadvantage in treating cardiovascular emergencies because they often lack paramedics, who are much more successful than basic emergency medical technicians (EMT) in treating cases of prehospital cardiac arrest (52). Some evidence suggests that paramedics are as effective as physicians in diagnosing and treating acute cardiovascular emergencies (52). The skills of the basic EMT can, however, be upgraded so that he or she can use an external defibrillator to improve the outcomes of patients suffering cardiac arrest.

Manual or automatic external defibrillators can be used to deliver electric countershocks to patients in ventricular fibrillation.[3] Manual defibrillators require the operator to read an electrocardiogram and to determine if the heart rhythm warrants the use of defibrillation. Automatic or "smart" defibrillators, developed in the early 1980s, perform these functions and deliver a countershock when ventricular fibrillation is detected. The automatic defibrillator allows persons with less medical experience and training to effectively treat critical dysrhythmia (79).

Paramedics and EMTs trained in advanced life support (e.g., intermediate EMTs) can use external defibrillators. In addition, basic EMTs can receive additional training in the use of external defibrillators and be certified as EMT-Ds (EMT-Defibrillators). Basic-level EMTs can be trained to use manual defibrillation in 16 to 20 hours and to use automatic defibrillators in about 4 hours (100). In the future, first responders and other community members may be trained in its use because automatic external defibrillators are so easy to use (52). Family members or fellow workers may defibrillate cardiac arrest victims at home or at work with a recently developed device that is stationed at home or work but is connected to a hospital base station by phone. When a cardiac arrest occurs, the bystander can activate the device to dial the hospital base station automatically, and after getting advice from a physician (based on electrocardiogram readings), a defibrillating shock can be administered by phone (36).

Defibrillators, when used effectively by EMTs, can potentially save one out of five cardiac arrest victims if used soon after a cardiac arrest (52), and some studies have found lower cardiac arrest mortality in communities where EMTs have been trained to defibrillate (102). Not all communities, however, have the resources or the conditions that would

[1]Coronary heart disease is caused by changes in the arteries leading to the heart (coronary arteries) that interfere with adequate blood flow.

[2]A successful resuscitation is one that results in the patient surviving to hospital discharge (52).

[3]Ventricular fibrillation, the rhythm most often associated with cardiac arrest, is a condition in which the heart muscles twitch in an uncoordinated fashion, interfering with the pumping of blood (115).

Table 5-1—Deaths Attributed to Cardiovascular Disease by MSA/non-MSA Residence, 1986

Cause of death	U.S.		MSA		Non-MSA	
	Number	Crude[a] death rate (per 1,000)	Number	Crude death rate (per 1,000)	Number	Crude death rate (per 1,000)
All causes	2,105,361	8.7	1,533,914	8.3	571,447	10.1
Major cardiovascular diseases[b]	968,240	4.0	696,865	3.8	271,375	4.8
Diseases of the heart[c]	765,490	3.2	554,564	3.0	210,926	3.7
Ischemic heart disease (coronary heart disease)[d]	520,729	2.2	377,888	2.0	142,841	2.5
Other heart disease[e]	215,315	0.9	153,527	10.8	61,788	1.1

[a]The crude death rate is calculated by dividing the number of resident deaths by the area's total population. It is not adjusted to take an area's age distribution into account.
[b]ICD-390-448.
[c]ICD 390-398, 402, 404-429.
[d]ICD 410-414.
[e]ICD 415-429.

SOURCE: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Center for Health Statistics, Vital Statistics of the United States, 1986, vol. II—Mortality, Part B, table 8-9.

permit effective use of this technique by EMTs. Furthermore, a few States do not permit basic-level EMTs trained as EMT-Ds to operate the defibrillation equipment (74).

EMT-D programs are most cost-effective in communities with more than a thousand people, or those large enough to expect more than one out-of-hospital cardiac arrest each year. The costs of instituting an EMT-D program include training and equipment cost[4] and the salary of a medical director. In order to institute an EMT-D program, a medical director must assure quality control through supervision of trained EMTs.[5] In some States, "standing orders" from the medical director permit EMTs to defibrillate, while other States require direct radio contact (telemetry) with the medical director.[6] Defibrillation, to be effective, must be instituted shortly after the onset of the heart attack. EMT-D programs are therefore most effective where cardiac arrests are witnessed and when CPR is started by bystanders or emergency personnel within 4 minutes of the victim's collapse. In addition, EMT response times must be short—not more than 10 minutes—or the chances of survival are slim (115,130).

If communities are small, community members are not trained in CPR, and response times are 10 minutes or more, a community should direct its resources to improving these conditions before instituting an EMT-D program (115,130). Because most cardiac arrests occur at home, in men over 60 years old, some have recommended that CPR training be targeted to middle-aged women and that physicians encourage the families of cardiac patients to learn CPR (52). Several communities have developed dispatcher CPR programs where an EMS dispatcher offers CPR instruction to bystanders until an EMS crew arrives at the scene (52).

Rural providers may have difficulty maintaining manual defibrillation skills, as some estimates indicate that a rural EMT-D in a small community may manage a cardiac arrest as seldom as once every 8 years (100).[7] To overcome this problem, practical skills review should occur at least every 3 months (52). Automatic external defibrillators (AEDs) are particularly well suited to the needs of rural areas because they are easier to use than manual defibrillators and do not usually require recertification (100). Basic-level EMTs can quickly learn how to place the defibrillator's paddles and to start the automated system. The AED will defibrillate only in the presence of ventricular fibrillation.[8]

[4]Small automatic defibrillators are available for between $5,000 to $9,000, making them affordable for many rural communities.

[5]Detailed, step-by-step information on planning and implementing an EMT-D program was published in a three-part article in the Journal of Emergency Medical Services (33,34,35).

[6]The license of the medical director provides the authority for certified EMTs to diagnose cardiac arrhythmias and to use a defibrillator.

[7]The responsibility for relatively few cardiac arrests (approximately 1 per 1,000 population per year) may be shared by as many as 20 volunteers in a small community (100).

[8]Verification that a patient is actually in cardiac arrest by determination of pulselessness is critical and yet difficult for the untrained. Other conditions such as seizures might confuse medically unskilled operators and potentially, a countershock could be lethal if administered inappropriately (52).

Improving rural response time to cardiac arrest calls can be achieved by stationing defibrillators with one or more on-call EMT-Ds instead of with the ambulance. EMTs carrying defibrillators can proceed directly to the patient while another EMT goes to the station house for the ambulance. Some rural ambulance services are notified by pager or telephone and then respond first to the ambulance garage, then to the patient. Some services require ambulances to remain at the garage until at least two or even three EMTs arrive, which delays response (100).

Prehospital care providers may become more involved in the treatment of patients with acute myocardial infarction. Thrombolytic agents—drugs to restore blood flow to the heart—are now common emergency room treatments for this type of heart attack. Some evidence suggests that if an adequate diagnosis is made, patients can safely be given thrombolytic treatment in the field and transferred by ambulance (89). This may be a promising intervention in some rural areas where time to emergency room care is long.

TRAUMA CARE

Injury[9] occurs with about equal frequency in urban and rural areas but tends to be more severe in rural areas (table 3-2). Motor vehicle accidents, for example, occur with equal frequency (see table 3-5) but are more likely to occur at higher speeds in rural areas and result in more serious injuries. Motor vehicle-related mortality is consequently 1.6 times higher in rural than urban areas (table 3-6). From 15 to 30 percent of calls for EMS care in rural areas are related to injuries, but only about one-tenth of these calls would represent severe or critical injuries. When severe injuries do occur, they require immediate medical attention and, sometimes, specialized trauma care that may be far from rural areas. A number of factors may contribute to the severity of injury and higher injury-related mortality seen in rural areas (55):

- there may be long delays between the injury and its discovery by a passerby;
- it may take a long time to get a patient from the scene of an accident to a hospital because of distances between the scene, the ambulance service, and the hospital;
- prehospital care in many rural areas may be performed by volunteers with basic EMT or first aid level training who are unable to provide advanced airway management or volume resuscitation;
- emergency departments in small rural hospitals may be staffed by primary care physicians without the knowledge or skills needed for critical trauma management;
- there may be relatively few trauma cases at the rural hospital, making it difficult for physicians and nurses to maintain their skills;
- rural hospitals may not have 24-hour physician and ancillary staff coverage (e.g., anesthesia, X-ray, and lab); and
- in situations involving multiple victims, delays may occur in the initial stabilization of the patients because there are too few physicians or nurses available.

As many as 50 to 60 percent of critically injured trauma patients die before reaching the hospital (5) and another 20 percent die within the next 4 hours (66). Some estimate that 20 to 45 percent of those who reach the hospital alive but eventually die could be saved if regional systems of trauma care were in place (16,19). Some argue that less than 10 percent of the United States has an effective trauma system in place, but that with additional support, existing technology and expertise could be organized to prevent these avoidable deaths (16,19). Basic information is lacking, however, on when, where, and why rural injury and injury-related deaths are occurring. Before implementing programs to improve rural trauma outcomes, it would be useful to know more about the causes and consequences of rural trauma, where along the continuum of care deaths are occurring (e.g., during the prehospital or hospital phase), and whether these deaths are potentially preventable. Implementing programs without such information may lead to inefficient use of limited resources (24).

With available information, it is difficult to know where to place limited resources. For example, if the excess motor vehicle-related mortality in rural areas occurs because of delays in discovering victims who have had accidents on infrequently traveled rural roads, improvements in the medical care system will probably not prevent these deaths. Instead, improvements in road safety or communications (e.g.,

[9]Injury and trauma are synonymous terms.

placing more call boxes along the sides of roads) may prove effective. Severity of injury in rural areas may be higher because of a lack of adherence to effective preventive practices. If, for example, rural residents are less likely to use seatbelts, are more likely to exceed speed limits, and drive while drunk, public education campaigns and better enforcement of existing laws to support preventive practices might effectively reduce motor vehicle-related morbidity and mortality.

Because time to emergency care is such a crucial factor in determining the trauma patient's outcome, higher trauma-related mortality might be expected in rural areas due to delays in detection and response times. In some remote rural areas, delays are unavoidable, but response times can be improved in some areas by increasing the number of available ambulances, improving air medical services, or changing the placement of ground or air transport. Reducing delays to emergency care can also be accomplished by shifting the onset of emergency treatment to the prehospital period. If rural EMTs were lacking the training to provide specific types of care that would benefit rural trauma patients, investing in EMT training would clearly be warranted. Training the public in basic emergency care so that accident bystanders are prepared to offer assistance until an emergency vehicle arrives could also extend the "golden hour" needed for trauma patients.

If there were evidence that prehospital care is adequate, but that deaths are occurring in rural hospitals that are ill-equipped to provide trauma care, then resources could be directed to improving hospital resources and the training of hospital-based nurses and physicians. It is possible that some rural trauma patients, needing the specialized services of trauma centers, are not being transferred to these facilities quickly, or at all. If this were the case, improvements in regional systems—specifically, the institution of protocols guiding the transfer of patients from a rural hospital to trauma centers—could be considered. Unfortunately, there is not much quantitative evidence available to help policymakers rationally allocate limited resources. This section reviews the available evidence and professional opinion that lend support to specific interventions aimed at improving the outcomes of trauma occurring in rural areas.

Prevention Education

There is evidence that public education is needed to improve rural residents' preventive health behaviors. Only 25 percent of rural residents report using seatbelts all or most of the time as compared to nearly 40 percent reported by urban residents. Not using seatbelts regularly appears to be a particular problem among young adult males in the rural West. Here, only 16 percent report using seatbelts all or most of the time, as compared to 30 percent among their urban counterparts (table 5-2). Seatbelt use reduces front-seat, passenger vehicle, occupant fatalities by about one-half (24).

The proportion of alcohol drinkers reporting that they had driven a car at least once in the past year when they thought they might have had too much to drink is generally not that much higher in rural than urban areas (18 percent v. 17 percent) but among young adults, especially those in the Midwest, drinking and driving appears to be a serious problem in rural areas. Among rural, Midwestern, young adult males who drink, over one-half report driving after having too much to drink (see table 5-3).

In addition to public education, States could be encouraged to adopt seatbelt laws and drunk driving laws and, where laws exist, actively enforce them. Thirty-four States have safety belt use laws and such laws reduce front-seat, passenger vehicle, occupant fatalities by about 7.5 percent (24).

Prehospital Care

There continues to be considerable controversy surrounding the appropriate level of prehospital care for trauma patients. The majority of EMTs in rural areas are trained to provide basic life support (BLS) prehospital care. Paramedics are trained in advanced life support (ALS) which permits them to initiate treatments including advanced airway management, administration of intravenous (IV) fluids, and decompression of tension pneumothorax. In the urban environment, where level I or II trauma centers are within 20 minutes reach, it may be better to have the trauma patient rapidly transported to the trauma center than to take time to provide ALS in the field (15). Some studies in urban areas suggest that this "scoop and run" approach is preferable because while providing prehospital ALS improves the chances that the trauma patient arrives at the hospital alive, it doesn't seem to improve the trauma patients' ultimate outcome (80). There are few controlled

Table 5-2—Percent of Persons 18 Years of Age and Over Who Wore Seatbelts All or Most of the Time When Riding in a Car by Sex, Age, and Residence: United States, 1985

	Both sexes All ages	Total male	18-29 years	30-44 years	45-64 years	65+ years	Total female	18-29 years	30-44 years	45-64 years	65+ years
Total MSA:											
All regions	38.9	36.9	32.5	40.1	38.5	36.5	40.6	39.3	44.2	39.0	38.9
Northeast	48.1	46.4	41.5	49.9	47.8	45.5	49.7	47.2	54.3	49.3	46.5
Midwest	37.9	34.7	31.1	38.0	36.2	32.7	40.6	38.5	45.0	38.5	39.7
South	31.2	30.5	29.0	32.4	31.2	28.0	31.9	31.8	35.0	30.2	28.8
West	40.5	37.7	30.2	41.6	39.6	41.3	43.1	42.6	46.0	39.8	43.8
Total non-MSA:											
All regions	25.5	23.7	19.9	26.9	24.4	22.7	27.2	28.5	27.2	29.2	22.8
Northeast	29.4	27.2	26.0	35.2	23.4	20.7[a]	31.6	41.6	32.4	30.5	16.7[a]
Midwest	26.6	24.1	21.4	25.7	24.8	25.1	28.8	26.2	31.7	30.3	26.3
South	22.3	21.2	18.6	22.9	22.4	20.2	23.3	25.6	22.6	25.0	19.2
West	30.2	27.5	15.9	33.8	32.0	26.7	32.8	31.6	29.2	39.3	30.5

[a]Figure does not meet standard of reliability or precision.

SOURCE: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Center for Health Statistics, Special Tabulation prepared for OTA from the 1985 Health Promotion and Disease Prevention Survey.

Table 5-3—Percent of Current Drinkers 18 Years and Over Who Had Driven a Car At Least Once in the Past Year When They Thought They Might Have Had Too Much To Drink By Sex, Age, and Residence: United States, 1985

	Both sexes All ages	Total male	18-29 years	30-44 years	45-64 years	65+ years	Total female	18-29 years	30-44 years	45-64 years	65+ years
Total MSA:											
All regions	16.6	22.4	35.6	23.8	11.4	2.6	9.5	17.2	9.7	2.4	0.5[a]
Northeast	11.6	16.4	27.4	18.9	7.6	1.5[a]	5.8	11.4	6.0	1.1[a]	0.2[a]
Midwest	22.1	30.3	44.1	33.1	15.8	5.3[a]	12.9	21.6	12.2	4.5	—
South	15.5	20.1	31.0	20.7	10.8	1.9[a]	9.3	16.3	9.3	2.4[a]	0.7[a]
West	17.6	23.6	40.8	23.5	12.2	2.2[a]	10.2	18.8	11.4	1.5[a]	0.9[a]
Total Non-MSA:											
All regions	17.9	22.5	40.5	21.0	9.6	2.3[a]	11.4	19.0	13.1	2.7[a]	0.2[a]
Northeast	16.3	20.4	40.9	14.9	11.8[a]	2.4[a]	10.8	16.2[a]	11.9[a]	5.0[a]	—
Midwest	22.0	28.5	51.7	27.8	10.1	1.8[a]	13.7	24.6	16.7	1.6[a]	—
South	14.0	17.4	32.9	14.5	6.0[a]	1.4[a]	8.6	10.7	11.0	3.3[a]	0.9[a]
West	18.6	23.4	34.3	27.4	15.3	4.8[a]	12.4	26.1	11.3[a]	2.6[a]	—

[a]Figure does not meet standard of reliability or precision.

SOURCE: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Center for Health Statistics, Special Tabulation prepared for OTA from the 1985 Health Promotion and Disease Prevention Survey.

studies of the benefits of prehospital ALS provided in rural areas, but on theoretical grounds, ALS is recommended as both appropriate and beneficial (15,83).

The effectiveness of some of the interventions included in ALS care have been questioned (18). There is no evidence, for example, that the pneumatic antishock garment that is standard equipment on ambulances is effective for victims of penetrating trauma when ALS is provided; there is little evidence that endotrachial intubation is useful when performed outside of the hospital; and there is some evidence that trying to expedite the administration of medication by starting IV lines in the field is ineffective (38).[10] Clearly, the effectiveness of the components of ALS and ALS care in general need to be further evaluated. Ironically, ALS providers are located principally in urban areas where they are less likely to be needed. If rural EMTs were trained to assume ALS responsibilities, they might have trouble maintaining their skills without continuing education programs accessible in rural areas. Even if ALS care were found to be beneficial in rural areas, many rural areas would find it difficult to compete for, or afford, the limited number of paramedics and intermediate-level EMTs that are available.

Hospital-Based Trauma Care

In rural areas where specialized trauma services are unavailable, the severely injured patient should be evaluated and stabilized expeditiously in the

[10]Sometimes IV lines are started so that when the patient arrives at the hospital, IV medication can be given immediately.

community hospital, and then triaged to the nearest trauma center (21,54). The quality of trauma care in rural hospitals can be improved by promoting physician and nurse education, instituting a trauma protocol, promoting prompt resuscitation and stabilization of patients before transfer, and implementing a quality assurance program, such as a monthly case review (131). Training opportunities tailored for rural physicians are available through the American College of Surgeons (ACS). A 2-day Advanced Trauma Life Support (ATLS) course was designed by ACS to meet the needs of rural physicians who must occasionally stabilize and transfer trauma victims but who do not see major trauma often enough to develop expertise in this type of care (20). Since training began in January 1980, about 90,000 physicians have been certified.[11] The American College of Emergency Physicians offers a 2-day Basic Trauma Life Support course for basic and advanced EMTs, nurses, and paramedics. The Emergency Nurses Association sponsors the Nursing Core Course, and the National Association of EMTs sponsors a course in trauma life support for prehospital care providers.

When 24-hour physician coverage is unavailable in a rural hospital emergency room, a trauma protocol can be implemented to help ensure that a physician and necessary ancillary personnel will be available by the time a trauma patient arrives, and that until the physician arrives, a well-trained nurse can assume immediate resuscitation and stabilization responsibilities. A rural hospital trauma protocol may begin with communications between prehospital providers at the scene in regard to the nature of the patients injuries and condition. When notified, the nursing supervisor can call members of an established trauma team that includes physicians, nurses, a laboratory technician, an X-ray technician, an anesthetist, and possibly a social worker and medical records clerk. While waiting for the patient to arrive, the nursing supervisor prepares the needed equipment and alerts the air medical service to prepare for a possible transport. Training rural hospital providers to assume these responsibilities and implementing such a protocol avoids confusion and delays. Case reviews help to assure appropriate rural hospital response and can include physicians from a regional trauma center (55).

Regionalization of Trauma Care

According to guidelines of the American College of Surgeons' Committee on Trauma:

> Each region must structure a trauma system in a manner that ensures the most prompt access to appropriate care and minimizes the risk of delay in diagnosis, delay in surgical intervention, and inadequately focused care, which are responsible for most of the preventable deaths from trauma (4).

The guidelines recognize that in rural areas, an injured patient may be at substantial distances from level I or level II trauma centers (see app. C for ACS criteria for level I, II, and III hospitals) and suggest that such patients should ideally be treated initially at the nearest available hospital facility. It is desirable that,

> . . . such a facility meet the requirements of a Level III trauma center or at least have emergency staff trained in advanced trauma life support. Patients with major injuries should then be secondarily triaged to more distanced Level I or II trauma centers, should local resources prove inadequate for continued care (4).[12] An organized regional trauma system that restricts specialized care to designated facilities has been shown to benefit patients with severe injuries (22).

According to the ACS, "In the ideal prehospital care system there is preplanning, ensuring optimal use of resources between communities and regions to minimize inefficiency and excessive cost" (4). Accordingly, among the essential components of a trauma system are the legal authority and a formal process to designate trauma centers, use of ACS standards in designating the trauma centers, use of patient volume or population data to ensure that the number of centers designated for an area are reasonable, presence of written triage criteria that form the basis for bypassing nondesignated hospitals, use of monitoring systems, and statewide coverage (133). A 1987 national survey of State EMS programs indicated that only two States[13] have

[11]The course and certification are available through the American College of Surgeons. There is no information available on how many of the certified physicians are rural practitioners or the type of physician certified (e.g., family practitioner, emergency physician).

[12]Revised ACS standards that include a section on "Optimal Care in the Rural Setting" are forthcoming.

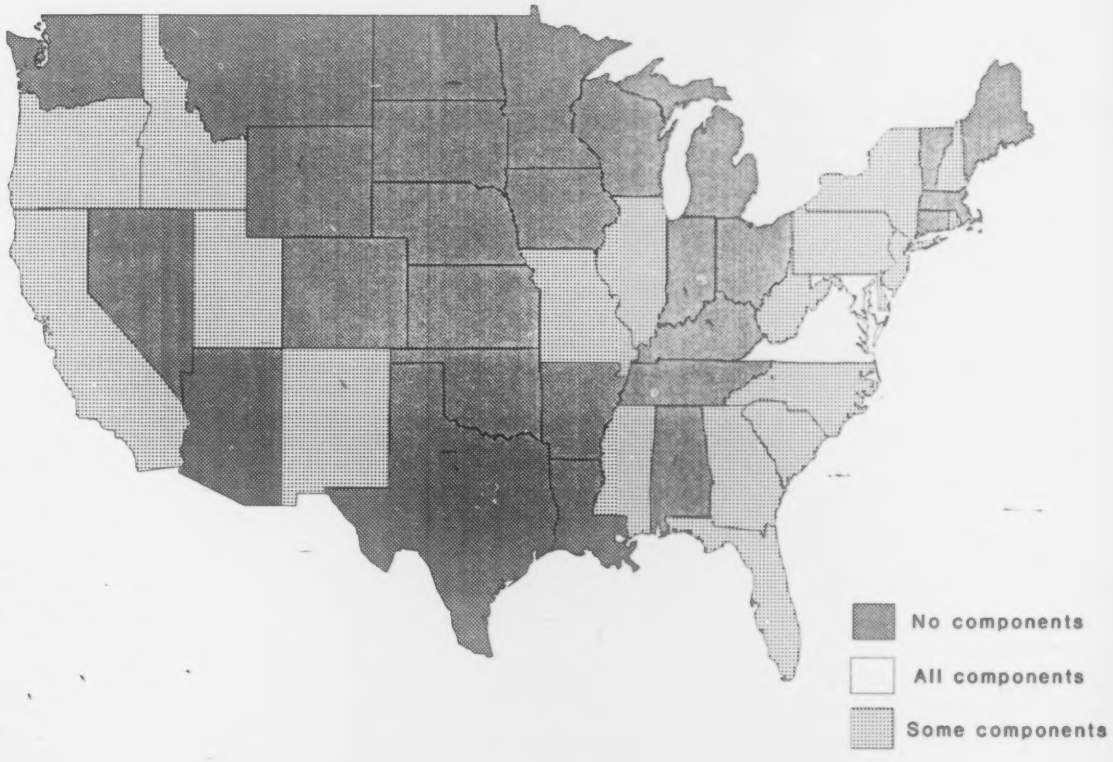
[13]The two States with comprehensive trauma systems are Maryland and Virginia.

trauma systems that include components deemed essential by the ACS Committee on Trauma (133).

At the time of the ACS survey, 2 States met all criteria, 19 States and the District of Columbia had designated trauma centers, but lacked statewide coverage and/or indicated that triage and quality assurance programs were inadequate, leaving 29 States that had not yet designated trauma centers (see figure 5-1). Somewhat different results were found in a survey of State EMS directors. According to this survey, also conducted in 1987, 14 States were designating trauma centers and another 22 were developing designation programs. An additional two States had verification programs with Standards. Only 13 States lacked either verification or designation,[14] and 3 of these States had developed standards (see figure 5-2).

Guidelines for trauma care systems have been developed by a number of professional organizations and by the Joint Committee on the Accreditation of Healthcare Organizations (JCAHO). Both the 1987 ACS guidelines and those published by the American College of Emergency Physicians (ACEP) take into account some of the unique features of rural health care. According to ACEP guidelines, some

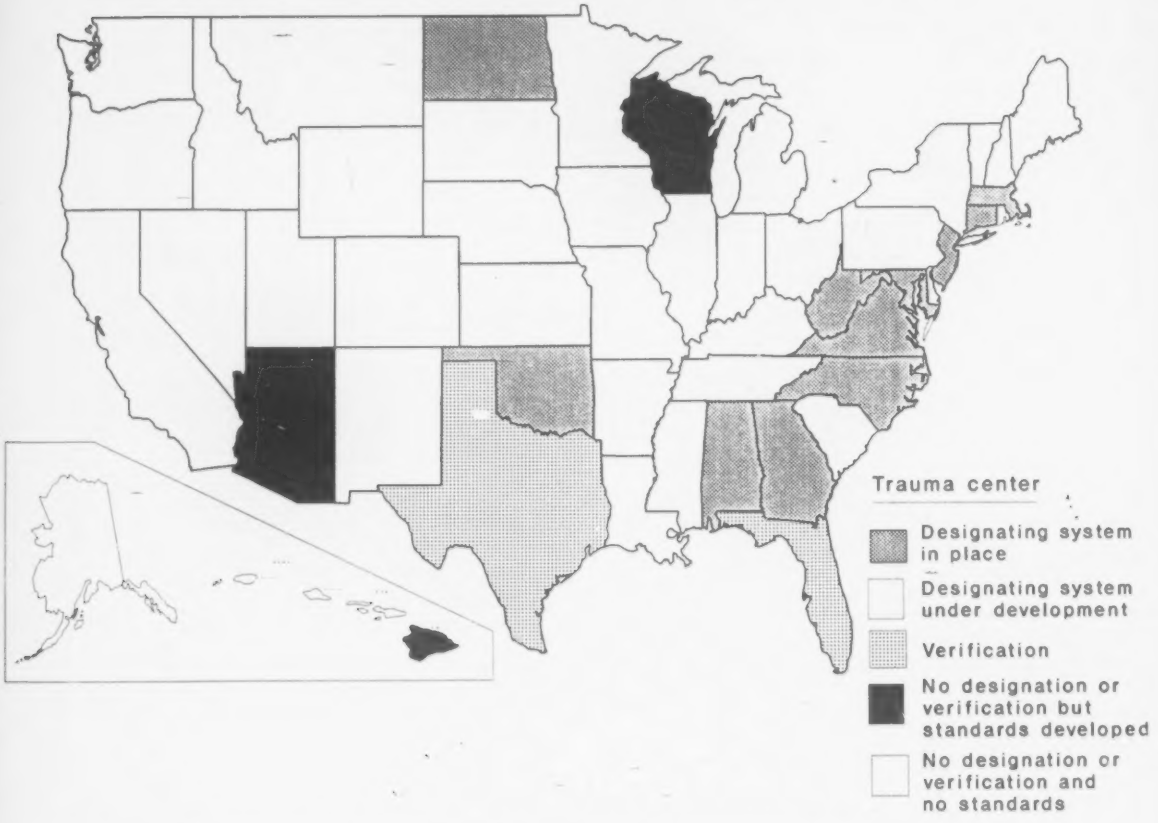
Figure 5-1—States Having All, None, or Some of Eight Essential Components of a Regional Trauma System According to American College of Surgeons' Criteria, 1987



SOURCE: J.G. West et al., "Trauma Systems: Arrest Status—Future Challenges," J.A.M.A. 259(24):3597-1445, June 24, 1988.

[14]Designation involves identifying a limited number of hospitals meeting specified criteria to serve the trauma needs of the State. In contrast, verification involves certifying any number of hospitals that meet specified criteria (108).

Figure 5-2—State Trauma Center Designation and Verification Practices, 1986-87


Trauma center
Designating system in place
Designating system under development
Verification
No designation or verification but standards developed
No designation or verification and no standards

SOURCE: National EMS Clearinghouse, "Emergency Medical Services: Transportation Systems and Available Facilities," 1988.

features of a trauma care system deemed "essential" in the urban environment are "desirable" in rural setting (see app. C).[15] Universal access through 911, for example, is essential in urban systems but desirable in rural areas. Few States with hospital trauma verification or designation programs are using the ACS or ACEP guidelines. Less than one-third (9) of the 32 States that reported the type of standards used in their programs reported using the ACS standards, according to the 1987 survey of State EMS directors. Instead, most had adapted ACS or ACEP guidelines to meet State or regional needs (108).

Some States have too many designated trauma centers. In Missouri, for example, there are 62 designated trauma centers, or 1 per 80,000 residents. This exceeds the recommended ratio of 1 trauma center per 350,000 residents (133).[16] Evidence suggests that some rural areas underutilize available resources. In one region in the Southeast, for example, relatively few life-threatening emergency

[15]Eleven components (i.e., medical direction, prevention, communication, training, triage, prehospital care, transportation, hospital care, rehabilitation, public education, and medical evaluation) of system management, prehospital care, hospital facilities and rehabilitation services are described as essential or desirable in urban and rural settings. ACEP defines an urban system as one that encompasses at least one metropolitan area with 250,000 persons. Rural systems are lacking any single population center (3).

[16]The recommended ratio is based on the average annual trauma rate of one case per 1,000 people and ACS's recommendation for a minimum of 350 patients per year at a level II trauma care facility.

cases were being transferred from rural hospitals to adjacent urban specialty hospitals (93).

Many rural hospitals cannot meet the requirements of an ACS level III hospital, but nonetheless have an important role to play in providing trauma care in rural areas. Specific trauma care guidelines for rural hospitals without level III resources might prove helpful to rural providers. Oregon, for example, designates a fourth level of trauma care, specifically to meet the needs of rural hospitals. A level IV hospital requires an ACLS-trained nurse to be in-hospital and immediately available, and an ACLS and ATLS-trained physician to be on call and promptly available (e.g., within the hospital, but not necessarily in the emergency room). (See Oregon hospital criteria in app. D.) The Oregon system ties the resources of the urban level I and II hospitals to the level III and IV hospitals to improve their trauma-related services. Level I and II hospitals must provide training for rural providers, provide feedback on patients referred to their hospitals by the level III and IV hospitals, and must provide peer review of trauma cases as part of a regional quality assurance program. Furthermore, Level I hospitals must provide telephone and onsite consultations with physicians of the community and outlying areas as part of an outreach program (25). There would perhaps be less controversy surrounding triage criteria if rural hospitals could establish their role in providing care and formalize beneficial relationships with specialty hospitals. The availability of rapid and aggressive treatment at the local level before and during transport to definitive care will likely improve rural trauma patient outcomes.

Chapter 6

Federal Policies Toward State Emergency Medical Services

States use many different sources to fund their emergency medical services (EMS) activities and EMS resources vary dramatically by State. In 1988, over 80 percent of States' EMS funds come from State or local sources (57). Only 14 percent of State EMS resources derive from Federal sources (figure 6-1). This, however, varies markedly by State. Nebraska, for example, relies entirely on Federal support while Florida relies entirely on State funds. In 1988, per capita spending for EMS varied from a low of $0.02 per capita in Ohio to nearly $14 per capita in Hawaii (table 6-1) (57).

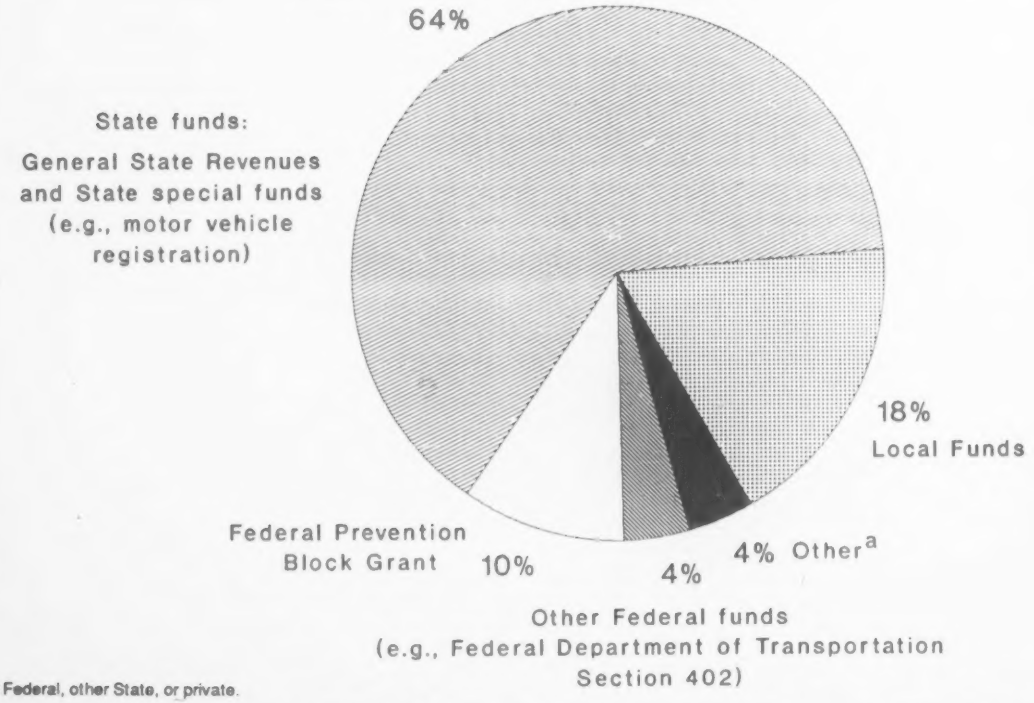
Federal support of State EMS programs derives from two sources, the Department of Health and Human Services (DHHS) and the Department of Transportation (DOT).

DEPARTMENT OF HEALTH AND HUMAN SERVICES

DHHS support of State EMS comes through the Preventive Health and Health Services Block Grant. EMS was among other categorical health programs that were folded into the block grant in 1981 following passage of the Omnibus Budget Reconciliation Act of 1981 (Public Law 97-35). The block grant program consolidated a wide range of activities (42 U.S.C. 300w-3(a)(1)):

1. rodent control and fluoridation programs;
2. hypertension control;
3. health services for defined populations, comprehensive programs to deter smoking and alcohol use among children and adolescents,

Figure 6-1—State EMS Program Funding, 1988



[a]Other Federal, other State, or private.

SOURCE: The National EMS Clearinghouse, "The EMS Office, Its Structure and Functions," The Council of State Governments, Iron Works Pike, Lexington, KY, 1988.

Table 6-1—State Expenditures for Emergency Medical Services, by Source of Funds, FY 1988

State	Total	Prevention block grant	Other Federal funds	State funds	Local funds	Other funds	State population 1988[a] (in 1,000s)	Per capita EMS spending
Total	**$133,228,378**	**$13,174,717**	**$4,851,348**	**$85,061,981**	**$24,070,475**	**$6,069,857**	**245,529**	**$0.54**
Alabama	342,888	0	83,857	259,031	0	0	4,119	0.08
Alaska	2,100,000	15,000	0	2,085,000	0	0	554	3.79
Arizona	3,134,064	0	U	389,174	U	2,744,890	3,542	0.88
Arkansas	349,760	0	0	349,760	0	0	2,400	0.15
California	6,714,207	1,741,207	152,000	3,871,000	950,000	U	28,074	0.24
Colorado	320,759	97,814	0	193,205	0	29,740	3,350	0.10
Connecticut	1,470,454	192,803	21,008	1,256,643	U	U	3,235	0.45
Delaware	95,400	0	0	95,400	0	0	649	0.15
District of Columbia	180,270	41,283	0	135,412	0	3,575	617	0.29
Florida	11,371,645	0	0	11,371,645	0	0	12,249	0.93
Georgia	2,481,533	1,118,254	0	1,355,883	0	7,396	6,384	0.39
Hawaii	15,304,684	167,792	0	15,136,892	0	0	1,101	13.90
Idaho	1,178,904	0	353,152	825,752	0	0	1,009	1.17
Illinois	1,113,024	0	50,661	1,061,327	U	1,036	11,584	0.10
Indiana	228,216	228,216	U	0	U	U	5,531	0.04
Iowa	422,232	313,826	0	108,406	0	0	2,803	0.15
Kansas	533,856	0	23,566	478,379	U	31,911	2,477	0.22
Kentucky	2,063,700	0	1,000	1,997,000	0	65,700	3,738	0.55
Louisiana	5,044,650	544,650	0	0	4,500,000	0	4,507	1.12
Maine	1,218,936	392,774	448,389	377,773	U	U	1,193	1.02
Maryland	6,720,000	20,000	1,200,000	5,500,000	0	0	4,599	1.46
Massachusetts	1,677,395	1,050,000	0	627,395	0	0	5,849	0.29
Michigan	1,494,746	524,964	13,384	924,398	0	32,000	9,231	0.16
Minnesota	21,343,889	388,471	0	2,334,943	18,620,475	0	4,271	5.00
Mississippi	1,358,101	0	64,065	185,641	0	1,108,395	2,661	0.51

[a]Projected population estimate.

ABBREVIATION: U = data reported as unobtainable by the respondent.

Table 6-1—State Expenditures for Emergency Medical Services, by Source of Funds, FY 1988—Continued

State	Total	Prevention block grant	Other Federal funds	State funds	Local funds	Other funds	State population 1988[a] (in 1,000s)	Per capita EMS spending
Missouri	943,659	422,638	60,865	460,156	0	0	5,132	0.18
Montana	436,562	162,134	U	274,428	U	U	811	0.54
Nebraska	511,000	511,000	0	0	0	0	1,593	0.32
Nevada	493,275	38,000	44,457	400,417	0	10,401	1,021	0.48
New Hampshire	732,573	593,696	U	138,877	U	U	1,088	0.67
New Jersey	2,865,046	544,720	215,782	2,104,544	U	U	7,756	0.37
New Mexico	1,650,000	714,404	0	935,596	0	0	1,557	1.06
New York	6,929,928	1,270,000	220,000	5,439,928	U	U	17,755	0.39
North Carolina	3,473,688	224,963	281,337	2,869,302	0	98,086	6,512	0.53
North Dakota	208,393	0	78,297	39,460	U	90,636	669	0.31
Ohio	198,000	3,000	175,000	20,000	0	0	10,779	0.02
Oklahoma	438,215	172,442	0	265,773	0	0	3,288	0.13
Oregon	715,842	50,751	203,668	226,443	U	234,980	2,733	0.26
Pennsylvania	7,500,000	0	0	7,500,000	0	0	11,860	0.63
Rhode Island	567,000	0	10,000	557,000	0	0	989	0.57
South Carolina	1,521,864	188,682	213,586	1,116,659	0	2,937	3,464	0.44
South Dakota	231,113	0	51,102	70,406	0	109,605	707	0.33
Tennessee	797,867	58,627	0	622,809	0	116,431	4,891	0.16
Texas	2,768,715	549,848	329,330	1,715,186	0	174,351	17,192	0.16
Utah	1,602,979	125,288	59,384	399,845	U	1,018,462	1,722	0.93
Vermont	216,507	0	47,500	169,007	0	0	552	0.39
Virginia	4,573,000	47,000	176,000	4,350,000	0	0	5,977	0.77
Washington	1,998,621	0	0	1,998,621	0	0	4,564	0.44
West Virginia	2,994,024	465,701	38,108	2,300,890	0	189,325	1,886	1.59
Wisconsin	335,800	99,950	235,850	0	0	0	4,797	0.07
Wyoming	261,394	94,819	0	166,575	0	0	505	0.52

ABBREVIATION: U = data reported as unobtainable by the respondent.

SOURCES: Public Health Foundation, Washington, DC, unpublished table, Nov. 3, 1989, U.S. Bureau of the Census, Current Population Reports, Series p-25, No. 1017.

and other risk-reduction and health education programs;
4. comprehensive public health services;
5. demonstrating the establishment of home health agencies in areas where the services of such agencies were not available;
6. feasibility studies and planning for EMS systems and the establishment, expansion, and improvement of such systems;[1] and
7. services to rape victims and for rape prevention.[2]

Under the block grant program, States can allocate funds to the seven service areas to suit their needs. In 1988, $13 million of block grant funds were spent on EMS, representing about 15 percent of all Preventive Health Block Grant funds available that year (table 6-2). Some States spend none of their block grant funds on EMS (e.g., Alabama, Kentucky), while others spend most of their block grant funds on EMS (e.g., West Virginia, New Mexico) (57) (table 6-2). More than twice as much money, about $30 million per year, had been available for EMS through the Federal EMS categorical grant program established following passage of the Emergency Medical Services Systems Act of 1973 (Public Law 93-154).

The 1973 EMS Systems Act program emphasized the development of regional systems to coordinate emergency medical services. Under the program, each of 303 defined EMS regions was eligible to receive grants for up to 5 years, after which they were to become self-sustaining (127). Rural areas were targeted for assistance. At least 20 percent of appropriations were made available to EMS systems serving rural areas. Furthermore, special consideration was given to applicants from rural areas seeking grants or contracts to support research in emergency medical techniques, methods, devices, or delivery.

A State's share of DHHS Preventive Health and Health Services Block Grant funding was frozen at its share of categorical grants that the State received for fiscal year 1981, the year legislation was enacted that combined categorical programs—including EMS services—into block grants. The block grant allocations to States do not reflect population distribution[3] because the categorical grant program had been a competitive one. Table 6-3 summarizes Preventive Health and Health Services Block Grant funding and the amount of these funds that States choose to spend on EMS since conversion from categorical to block grants in 1982, through fiscal year 1988. Since 1983,[4] States have allocated between $12 million and $17 million of block grant funds to EMS activities (table 6-3).

The impact of the imposition of the block grant program on State's EMS activities was evaluated in a 1986 General Accounting Office (GAO) report. GAO compared overall State EMS expenditures in six States[5] for 1981 (the last year of the categorical EMS Federal program), 1983 (the first year under the block grant), and 1985 (127). By 1985, total EMS funding had not returned to 1981 levels but EMS funding was increasing, primarily because of increased State funding of EMS activities. By 1985, States were assuming one-half of EMS costs as compared to 27 percent in 1981 (127).

DEPARTMENT OF TRANSPORTATION

The DOT EMS program began with the Highway Safety Act of 1966 (Public Law 89-564), which was enacted following two national studies showing major deficiencies in EMS services (70,81). Under the Act, DOT funds States to develop highway safety programs that include provisions for emergency services. DOT funding must be linked to its highway responsibilities. DOT's emphasis is therefore on the prehospital stage and the initial stages of hospital care for highway-injured patients, as well as on prevention and intervention activities that are highway-related (53 FR 11255). The State and Community Highway Safety Grant Program is referred to as the section 402 program. State funding under section 402 is apportioned among the States based on a State's population and public road mileage.[6] In 1987, nearly $5 million were available

[1]1984 legislation subsequently added grants for demonstration projects for the treatment of children for trauma or critical care (Public Law 98-555).

[2]Replaced in 1986 by "victims of sex offenses and for prevention of sex offenses" (Public Law 99-646 and Public Law 99-654).

[3]An exception to this are block grants funds earmarked for the "sex offenses" category, which are allocated according to population (53 FR 27766).

[4]1982 was a transition year from the categorical program to the block grant program.

[5]The six States that GAO studied were California, Florida, Iowa, Massachusetts, Pennsylvania, and Texas.

[6]Seventy-five percent of funds are allocated based on population and 25 percent are based on the public road mileage. A portion of funds is also reserved for Indian tribes (23 U.S.C. 402(c)).

Table 6-2—Distribution of Preventive Health and Health Services Block Grant Expenditures of State Health Agencies to Former Categorical Grant Areas, Fiscal Year 1988

States and territories	Total PHHS block grant expenditures	Fluoridation	Emergency medical services	Health education risk reduction	Home health services	Hyper-tension	Rape crisis	Rodent control	Other
Total	**$87,965,634**	**$3,816,498**	**$13,174,717**	**$16,479,926**	**$139,012**	**$15,991,318**	**$4,006,524**	**$3,254,801**	**$31,100,838**
Alabama	1,213,425	0	0	0	0	208,787	49,739	54,740	900,159
Alaska	271,400	0	15,000	256,400	0	0	0	0	0
Arizona	1,025,885	19,227	0	884,519	0	0	56,441	0	65,698
Arkansas	839,908	0	0	64,182	0	0	34,769	26,006	714,951
California	6,250,700	62,254	1,741,207	1,643,989	0	1,795,878	360,083	0	647,289
Colorado	1,086,086	52,097	97,814	0	0	49,296	45,076	0	841,803
Connecticut	1,473,649	0	192,803	691,284	0	162,661	73,659	0	353,242
Delaware	149,071	0	0	30,935	0	74,380	7,928	0	35,828
District of Columbia	797,658	0	41,283	130,975	0	120,610	9,702	264,000	231,088
Florida	3,349,759	581,501	0	576,183	0	1,316,670	125,941	0	749,464
Georgia	3,349,517	210,037	1,118,254	112,281	0	530,000	83,132	150,000	1,145,813
Hawaii	664,722	0	167,792	329,373	0	118,766	21,257	0	27,534
Idaho	256,830	0	0	241,230	0	0	13,800	0	1,800
Illinois	2,118,990	52,329	0	429,430	0	524,227	173,715	0	939,289
Indiana	1,766,991	249,613	228,216	160,854	28,174	462,263	135,956	80,631	421,284
Iowa	1,091,582	181,686	313,826	189,222	0	129,150	38,674	0	239,024
Kansas	805,455	0	0	206,115	0	133,539	35,952	0	429,849
Kentucky	1,343,323	0	0	669,023	0	375,000	88,000	0	211,300
Louisiana	2,887,213	458,117	544,650	0	0	498,913	68,108	69,240	1,248,185
Maine	892,342	133,869	392,774	139,121	0	165,566	17,111	0	43,901
Maryland	1,718,959	0	20,000	170,690	0	762,502	74,339	269,791	421,637
Massachusetts	2,852,170	287,883	1,050,000	476,969	0	199,783	194,086	0	643,449
Michigan	3,926,114	100,000	524,964	410,225	0	1,051,267	160,845	524,438	1,154,375
Minnesota	2,281,265	0	388,471	90,952	0	0	46,520	0	1,755,322
Mississippi	1,637,612	13,650	0	33,459	0	214,669	44,303	0	1,331,531

Table 6-2—Distribution of Preventive Health and Health Services Block Grant Expenditures of State Health Agencies to Former Categorical Grant Areas, Fiscal Year 1988—Continued

States and territories	Total PHHS block grant expenditures	Fluoridation	Emergency medical services	Health education risk reduction	Home health services	Hyper-tension	Rape crisis	Rodent control	Other
Missouri	1,967,827	0	422,638	164,694	0	337,487	71,067	28,726	943,215
Montana	659,780	19,126	162,134	48,412	0	0	19,700	0	410,408
Nebraska	1,522,035	11,756	511,000	71,412	39,028	240,483	60,622	75,000	512,734
Nevada	329,300	0	38,000	0	0	0	12,158	0	279,142
New Hampshire	1,254,191	0	593,696	376,095	0	0	15,030	0	269,370
New Jersey	2,669,004	3,942	544,720	532,230	0	945,689	85,564	348,806	208,053
New Mexico	1,323,067	31,309	714,404	27,484	0	197,892	19,800	0	332,178
New York	6,965,000	269,500	1,270,000	178,500	0	490,800	376,300	107,372	4,272,528[a]
North Carolina	2,950,920	170,595	224,963	969,167	0	595,475	66,830	0	923,890
North Dakota	262,947	0	0	162,182	0	98,064	2,701	0	0
Ohio	4,512,824	48,490	3,000	2,917,907	0	550,000	214,427	0	779,000
Oklahoma	647,247	0	172,442	94,000	0	175,719	46,024	0	159,062
Oregon	555,499	0	50,751	0	0	0	63,463	0	441,285
Pennsylvania	4,405,395	56,764	0	470,001	0	905,195	180,000	1,265,051	1,537,384
Rhode Island	432,468	0	0	404,078	0	12,000	16,390	0	0
South Carolina	1,211,631	0	188,682	130,216	16,594	451,933	47,453	0	376,753
South Dakota	234,700	0	0	12,882	0	27,942	14,261	0	179,615
Tennessee	1,274,569	79,901	58,627	271,058	55,216	393,340	85,576	0	330,851
Texas	3,620,486	347,281	549,848	240,710	0	54,836	216,052	0	2,211,759
Utah	709,746	0	125,288	409,145	0	83,103	23,710	0	68,500
Vermont	248,265	21,705	0	48,142	0	112,470	15,000	0	50,948
Virginia	2,511,304	296,186	47,000	727,379	0	694,549	215,201	0	530,989
Washington	883,648	0	0	0	0	336,014	62,836	0	484,798
West Virginia	822,779	59,680	465,701	92,468	0	53,400	29,670	0	121,860
Wisconsin	1,733,102	0	99,950	123,335	0	341,000	80,390	0	1,088,427
Wyoming	207,274	0	94,819	71,018	0	0	7,163	0	34,274

[a]$1.4 million of this amount was for New York's Healthy Neighbors Program.

SOURCE: Public Health Foundation, Washington, DC, unpublished table, Nov. 3, 1989.

Table 6-3—Preventive Health and Health Services Block Grant Expenditures: Emergency Medical Services, Fiscal Years 1982-88

Fiscal year	Block grant total	EMS expenditures	Percentage spent on EMS
1982	$32,174,000[a]	$ 4,776,000	14.8
1983	85,746,000	17,612,000	20.5
1984	81,822,000	15,132,000	18.5
1985	86,564,000	16,216,000	18.7
1986	88,701,000	16,407,000	18.5
1987	84,129,000	12,969,000	15.4
1988	87,966,000	13,175,000	15.0

[a] Block grant totals are low in 1982 because this was a transitional year.

SOURCE: Public Health Foundation, 1220 L St., N.W., Washington, DC 20005, Nov. 3, 1989.

Table 6-4—National Highway Traffic Safety Administration's State and Community Highway Safety Program (Section 402) Funding: Emergency Medical Services, Fiscal Years 1967-87

Fiscal year	NHTSA sec. 402 total	EMS sec. 402 total	Percentage spent on EMS
1967-76	$639,157,700	$89,074,300	13.9
1977	125,700,100	16,996,500	13.5
1978	168,699,600	22,686,900	13.4
1979	167,096,000	13,535,500	8.1
1980	190,243,000	18,771,900	9.9
1981	169,991,900	12,721,900	7.5
1982	92,582,300	5,438,800	5.9
1983	91,845,200	4,964,800	5.4
1984	95,077,800	4,466,800	4.7
1985	120,619,000	5,332,600	4.4
1986	116,827,500	5,315,200	4.6
1987	111,539,200	4,708,900	4.2

SOURCE: Traffic Safety Program, National Highway Traffic Safety Administration, U.S. Department of Transportation, "FY 1987 Summary of State and Community Highway Safety Obligations (Section 402)," Nov. 13, 1987.

to States through the 402 program (table 6-4). This represents about one-fifth of Federal EMS resources and about 3 percent of all EMS expenditures (i.e., State and Federal) (figure 6-1).

DOT also has research, development, and demonstration funds to support State or local agencies in the areas of highway-safety personnel training and research, accident investigation procedures, and emergency service plans (referred to as the Section 403 program). In 1988, DOT allocated just over 700,000 through the section 403 research and demonstration program.

Section 402 Funds for State Highway Safety Plans

DOT has determined that the following seven programs have been the most effective in reducing accidents, injuries, and fatalities, and DOT supports inclusion of countermeasures in these areas into State's Highway Safety Programs (53 FR 11255):[7]

1. Alcohol and Other Drug Countermeasures.
2. Police Traffic Services.
3. Occupant Protection.
4. Traffic Records.
5. *Emergency Medical Services.*
6. Motorcycle Safety.
7. Roadway Safety.

DOT has guidelines for State Highway Safety Programs and to receive funds, a State must have its highway safety program approved by DOT. The guidelines related to EMS are as follows (23 CFR 204.4):

> Each State, in cooperation with its local political subdivisions, should have a program to ensure that persons involved in highway accidents receive prompt emergency medical care under the range of emergency conditions encountered. The program should provide, as a minimum, that:
>
> 1. There are training, licensing, and related requirements (as appropriate) for ambulance and rescue vehicle operators, attendants, drivers, and dispatchers.
> 2. There are requirements for types and number of emergency vehicles including supplies and equipment to be carried.
> 3. There are requirements for the operation and coordination of ambulances and other emergency care systems.
> 4. There are first aid training programs and refresher courses for emergency service personnel, and the general public is encouraged to take first aid courses.
> 5. There are criteria for the use of two-way communications.
> 6. There are procedures for summoning and dispatching aid.
> 7. There is an up-to-date, comprehensive plan for emergency medical services, including:
>   a. Facilities and equipment.
>   b. Definition of areas of responsibilities.
>   c. Communications systems.
> 8. This program should be periodically evaluated by the State and the National Highway Traffic Safety Administration should be provided with an evaluation summary.

[7]Other areas may be funded, but only if the State can provide a specific rationale and convincing information that this is a special needs area.

Table 6-4 summarizes section 402 funding through NHTSA and the percent of total funds that have been expended on EMS. In 1987, over $4.5 million was expended on EMS, representing 4 percent of all section 402 funds (figure 6-2). The availability of section 402 money dropped precipitously in 1982 at the same time the DHHS categorical EMS program was replaced by a block grant program (for which funding was also decreased significantly). The portion of section 402 funds used for EMS has declined by a factor of 3 in the last 10 years (i.e., from 13 to 4 percent), in part because of increased funding of other program areas, such as for alcohol countermeasures and occupant protection. Some 402 funds have been earmarked for occupant safety and other programs.

Section 403 Highway Safety Research and Demonstration Funds

DOT funds training, research, planning, and demonstration activities in the area of integrated prehospital/hospital trauma care delivery systems through section 403 of the Highway Safety Act (23 U.S.C. 403) (124). With the 1981 merger of DHHS's EMS program with other categorical programs into the Preventive Health and Health Services Block Grant, DHHS support for EMS research and development, and demonstration grants ceased, leaving DOT as the only Federal source for these types of EMS activities. In 1988, 7 percent of section 403 funds (i.e., $705,000) were spent on EMS. EMS research and development funding has more than doubled from 1981-88 (table 6-5).

DHHS AND DOT ALLOWABLE EMS EXPENDITURES

Both DOT's and DHHS's programs in which EMS is included contain quite a wide range of allowable activities; e.g., in DOT's program, traffic records, and in DHHS's program, rodent control, are other allowable activities. Congress has earmarked a significant portion of funds for some of these activities but has never done so for EMS. The source of Federal funds places limits on the kinds of EMS activities and equipment that a State is allowed to finance with these funds. DOT's funds must be used for highway-related EMS services—i.e., principally victims of motor vehicle accidents—so understandably, DOT's funding priorities emphasize prehospital EMS activities and trauma care. EMS equipment purchases were not permitted under the EMS Systems Act, and until 1988 were not permitted under the block grant program. In 1988, however, Congress changed the law so that block grant funds could be used "for the payment of not more than 50 percent of the costs of purchasing *communications* equipment [emphasis added]. . ." (Public Law 100-607). EMS grant support through DOT may be used by States for training and major equipment, including up to 25 percent of the cost of an ambulance (47 FR 40791).[8]

CONCLUSIONS

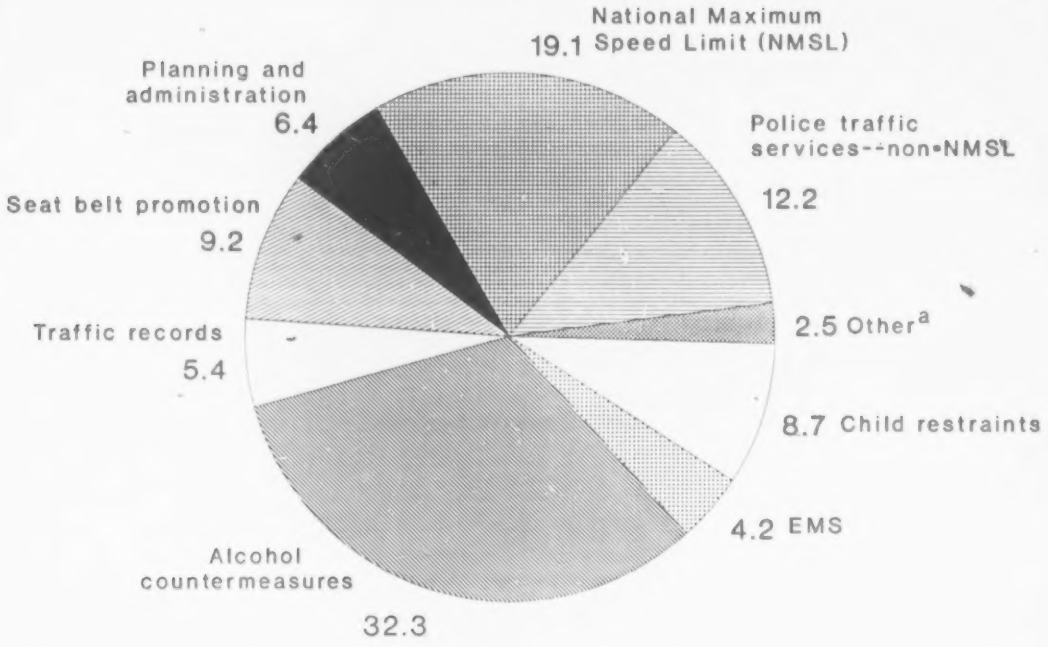
Providing EMS services has become more of a State function in the last decade. Federal support for EMS through both DHHS and DOT decreased sharply in the early 1980s, falling to approximately half of previous levels. Federal support now accounts for only 14 percent of State EMS expenditures. The primary goal of the 1973 EMS Systems Act, to blanket the country with quality EMS services, has not been realized. State-to-State variability in EMS systems is marked, and within States, rural areas are more likely to lack resources and comprehensive systems than urban areas. Several States have established dependable, constant sources of funds to support their EMS systems. Other States, however, have not become self-sufficient, remain dependent on Federal sources, and have fragmented EMS programs.

Most State EMS directors view providing EMS as the primary responsibility of the State and local governments and the shift of EMS responsibility to the States as appropriate (112). Federal resources have never been sufficient or consistently available enough to rely on for EMS operations. Federal resources have been successfully used, however, to provide incentives for States to implement planning efforts, to promote training of EMS providers, to provide technical assistance, and to conduct EMS-related research. It is in these areas that States continue to need Federal leadership (112).

Recent congressional interest in rural-oriented health care legislation and EMS/trauma-related legislation may make additional Federal resources available for *rural* EMS. During the 101st congressional session, several bills were introduced that relate to EMS and trauma care systems. (See bill

[8]DOT will provide more support if the State documents higher than 25 percent highway safety ambulance utilization.

Figure 6-2—State and Community Highway Safety Program Obligations (DOT Section 402)
Fiscal Year 1987—$111,539,200



[a]"Other" program areas include school bus driver training, motorcycle safety, and pedestrian safety, plus the other standard areas.

SOURCE: Associate Administrator, Traffic Safety Program, National Highway Traffic Safety Administration, U.S. Department of Transportation, "FY 1987 Summary of State and Community Highway Safety Obligations (Section 402)," Nov. 13, 1987.

Table 6-5—National Highway Traffic Safety Administration's Research and Demonstration Program (Section 403) Funding: Emergency Medical Services, Fiscal Years 1981-88

Fiscal year	NHTSA sec. 403 total	EMS expenditures	Percentage spent on EMS
1981	$5,759,000	$305,000	5.3
1982	4,555,000	440,000	9.7
1983	4,300,000	242,000	5.6
1984	6,240,000	305,000	4.9
1985	8,383,000	334,000	4.0
1986	8,558,000	515,000	6.0
1987	10,872,000	656,000	6.0
1988	9,909,000	705,000	7.1

SOURCE: Personal communication, Traffic Safety Program, National Highway Traffic Safety Administration, U.S. Department of Transportation, Feb. 15, 1989.

digests in app. E.) The Emergency Medical Services and Trauma Care Improvement Act of 1989 (S. 15), for example, introduced in January 1989, would establish a National Clearinghouse on EMS and Trauma care, and establish grant programs to support the development of State trauma care systems. A July amendment to S. 15 would establish a separate grant program to improve *rural* EMS (Cong Record, S8521, July 10, 1989). The Comprehensive and Uniform Remedy for the Health Care System Act of 1989 (S. 1274) includes provisions for an EMS grant program and directs resources to States with rural areas. The legislative proposals vary in their approach to the problems facing EMS. Some propose a more active Federal role in system development and include national standards for certain EMS facilities. Others provide for additional funds for EMS systems but give States discretionary spending authority. Many legislators have recognized the special problems of rural EMS programs and have attempted to direct resources to these areas.

Appendix A

Rural EMS Workshop Participants

Workshop held May 4 and 5, 1989. Cosponsored by: The Department of Transportation, National Highway Traffic Safety Administration and The Office of Technology Assessment

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Appendix B

Designing an Appropriate EMS System in Rural Areas: Use of a Computer Simulation Model

A computer simulation model (called RURALSIM) has been designed to allow planners to examine how their present emergency medical services (EMS) system functions and to determine the effects introducing changes into their systems.[1] The model also allows planners to set goals for long-term system improvements and to determine if the goals can be met with available resources. RURALSIM was intended to help local decisionmakers allocate scarce EMS funds efficiently and to address specific questions such as:

- Are an appropriate number of emergency response vehicles in the area?
- Are they appropriately located within the region?
- Are the personnel on these vehicles trained at the appropriate level to serve the population in the area?
- Are helicopters and fixed-wing aircraft required as part of the system and where should they be located?

In this section, the computer simulation model is described as are its attempted implementation in several rural areas.[2]

The Computer Simulation Model

RURALSIM analyzes the effects of changes in the EMS system in terms of a number of performance measures such as response time, level of response, and vehicle utilization. The model uses local EMS demand and response data to generate predicted occurrence and responses at various times of day for a given area. The planner can hold the area's demand for EMS services constant and then alter the configuration of system resources. The effects of introducing changes such as vehicle placement and relocation strategies, vehicle dispatching policies and alternative forms of prehospital care can then be evaluated. EMS planners can use RURALSIM to evaluate the cost of alternative EMS configurations that achieve the desired goals, can modify the system's goals relative to cost constraints, and maximize system effectiveness given a particular cost base.

RURALSIM can take into account several different attributes of the region under study. These can be divided into five categories:

1. technological configurations of an EMS system including access, communications, vehicle and resource deployment, field treatment, transportation, and definitive treatment facilities;
2. different placement strategies for response and transport vehicles including first responders, Basic Life Support and Advanced Life Support providers, and the availability of rescue land and air vehicles;
3. characteristics of the region's environment including populations and the affect of particular population attributes, geography, roads, and weather conditions upon EMS demands, and response capabilities;
4. policies and operating rules for the different EMS system components including dispatch policies; vehicle re-allocation, transport, and first responder policies; and hospital designation policies, which affect patient transport; and
5. changes in demand patterns caused by population fluctuations and/or seasonal population shifts.

The model defines demand as a request for either emergency field treatment or routine transportation services. Within these two categories, demand is further subdivided according to type of case and severity level. Emergent case types may include: cardiac, trauma (non-motor vehicle related), and motor vehicle accident, and non-trauma/non-cardiac. Special categories of incidents (e.g., basic manufacturing, mining, river) can also be included. For each type of emergent incident, three levels of presenting severity are typically defined: life threatening, severe, and minor/moderate. In addition to classifying demand by type and severity, RURALSIM also allows for variation in the demand rates by time of day and day of week.

RURALSIM must not only generate the emergency incident according to type, severity, and time, but must also determine its location. In order to do this, a network model is used to represent the region's transportation system. The area's primary roads, important secondary roads, intersections, and population clusters are modeled.

Once an incident has been generated, the access component models the process which occurs between the time of the incident and the time when initial contact is made with the EMS system. The events which occur in this period include incident detection, possible aid rendered by a citizen, and EMS system access utilizing public telephone, radio, call box, or direct contact. Given the complexity of the access problem and the unavailability of representative data, this process is modeled in terms of the probability that an incident is witnessed, the time for discovery of unwitnessed incidents and the time to

[1]The development of the computer simulation model occurred from 1979 to the mid-1980s by researchers at the University of Pittsburgh, Health Operations Research Group with support from the U.S. Department of Transportation (Shuman and Wolfe, 1989).

[2]Four rural sites were used to develop RURALSIM: 1) Aroostoock, Penobscot, Piscataquis, Waldo, Hancock, and Washington Counties in Maine; 2) Camden, Miller, and Morgan Counties (Lake of the Ozarks) in Missouri; 3) Craig, Delaware, Mayes, Muskogee, and Okmulgee Counties in Oklahoma; and 4) Indiana County in Pennsylvania.

contact the EMS system. These access probabilities and parameters must typically be estimated by EMS planners since little data are available. They may be varied in different simulation experiments in order to assess their effects.

Three types of communication functions are considered in RURALSIM: the initial request for assistance to activate (access) the EMS system; communications between the EMS dispatch center and the ambulance vehicle base station; and communications between the EMS dispatch center and a responding vehicle away from the base for the purpose of directing or redirecting the vehicle to or from an incident scene and for the purpose of relaying medical information and receiving medical command. The system access is assumed to be via telephone and is modeled as a time delay. Randomly generated time delays are also introduced depending on the type of dispatch facility available (e.g., with or without 911), and the means of communication with the base stations. Communications between the dispatch center (or medical command) and a vehicle away from base are not explicitly modeled (e.g., number of radio channels, etc.) but are assumed to be available for the purpose of redirecting or calling off a vehicle.

The EMS system response function is concerned with ambulance vehicle dispatch, prehospital treatment, and patient transport. As input to the model, each ambulance vehicle must be specified according to its type (BLS, ALS, Rescue, or First Responder), base station, crew availability, level of crew training, and shifts in service.

The heart of RURALSIM is its "dispatcher" module. A series of decision rules has been programmed into RURALSIM to replicate the manner in which the simulated region's dispatchers would function. The dispatcher must assign the different types of vehicles in accord with the perceived severity of the incoming call. If primary and secondary vehicles are not available, RURALSIM can search for the closest available vehicle, reassign a vehicle, or queue the patient until an appropriate vehicle becomes free.

Time spent at the scene is determined by the type and severity of the incident, and the highest level of capability of the responding vehicles (BLS or ALS). Two variables are involved in the field transportation function—the decision to transport and the choice of destination. Patients may not be transported if their condition does not warrant it, or if transportation is refused. Destination for emergency patients is typically a hospital within the region or an adjoining area. Location, type and severity of the incident typically determine the receiving institution. Patients picked up at a hospital may be transported to another hospital, an extended care facility, or the patient's residence.

The internal workings of the definitive care treatment facilities (hospitals) in the region are explicitly excluded from the model since little is to be gained by their inclusion and their introduction would further complicate the model. Hospitals are modeled primarily as destinations for the transportation of patients.

RURALSIM collects relevant information on each simulated patient which describes the incident type and location, response times, and the resolution of the case. Output information on each patient includes: incident type, severity level, location, time of incident, time dispatch contacted, time each responding vehicle contacted, time each vehicle left its respective base or location, time each vehicle arrived at the scene, time patient transported (or left scene), time patient arrived at receiving facility, and time each vehicle was back in service. From these profiles, response times, delay times, and total EMS service times can be determined for each incident.

A number of measures of effectiveness are utilized to facilitate the comparison of alternative configurations and policies. These include average BLS and ALS response times, time first vehicle arrives at scene, percent of patients serviced (vehicle at scene) within 4 minutes of contacting the dispatcher, percent of patients serviced in more than 10 minutes, the average time for each component of the incident (access, dispatch, response, field treatment, and transport), and vehicle utilization. Other measures such as the number of times a vehicle is unavailable for emergent requests and average patient waits can be included.

A number of EMS options for improving an area's EMS system can be evaluated by RURALSIM. The model allows planners to develop innovative strategies to use available resources to reduce the response time for critically injured patients and thus improve the care delivered at the scene.

Options to improve EMS access that can be considered in the modeling exercise include using more efficient communications systems, improving response (by enabling care to be delivered to the scene with an acceptable response level), improving transportation, improving skill maintenance of prehospital providers and improving the hospital or clinic response capability. In a rural area the options must be chosen with respect to available services and individuals; the size and distribution of population clusters; and the social, cultural, economic, political, and geographic constraints and incentives characteristic of the specific community.

Three major groups of options are available to a community:

- those that facilitate the development of a new rural EMS system;

- those that provide linkages for small population clusters and;
- those that offer solutions to specific problems in an existing rural EMS system.

The first option group is, in reality, a process for building an EMS system from scratch. The simulator can help develop a set of steps for building an effective EMS system in a rural area. The second option group pertains to those communities that already have some form of EMS, but do not appear to have the resources required to achieve a desired level of service. These options include an evaluation of various configurations of communities cooperating with each other in order to provide a more effective system. Finally, there are options which are directed at specific problems facing a functional EMS system (e.g., communication systems). For any specific EMS area, options from any or all three groups might be important to evaluate through simulation.

During field testing of the model in several rural areas, numerous shortcomings of the simulation model were noted. These shortcomings included:

- it required data that was not available in rural areas;
- it was so complex, it required reconfiguration before it could be used in different rural environments;
- results from simulations were not available in time for local planners to use the information; and
- a rational EMS system as specified by the model was not implemented because there were limited planning resources within the region and because of various social and political constraints.

Example: Aroostoock County, Maine

The population of Aroostoock County, Maine was approximately 100,000 at the time of the field test. The population was scattered among 71 towns (most with a population under 1,000) most of which were spread over a 7,500-square-mile land area. At the time of the study, the county was served, somewhat sporadically, by 12 independent BLS ambulance providers. The development of a countywide system and/or the introduction of ALS capabilities was being considered.

The impact of several EMS system changes were evaluated including:

- using an ALS non-transporting unit which operated out of the region's hospitals and from some of its more rural clinics;
- downgrading several very low volume BLS units to IRP status; other BLS units were redeployed to provide both first response and transportation in conjunction with an ALS (non-transporting) unit;
- a transport vehicle unit was created to provide interfacility transportation from the rural hospitals to the State's tertiary and secondary care facilities (a trip of up to 4 hours or more in some cases).

The results of this seemingly ideal and cost-effective alternative were for the most part very promising: Average response times for a number of areas would be reduced by up to 2 minutes. However, even though the number of BLS vehicles deployed was reduced while an ALS capability was introduced, the rural nature of the area was not conducive to an acceptable ALS response times that remained relatively high (12.5 to 14.0 minutes). Further, the long-haul transfer vehicles were not utilized with the anticipated frequency, and hence, did not lead to significant system improvement.

While RURALSIM provided planners with a considerable amount of information, much of its potential value was not realized, in part because there were delays due to data limitations and because RURALSIM needed to be reconfigured. Primary reasons for selecting Maine as the first test site were its computerized EMS data system, the only such statewide system in existence at that time, and the sophisticated staff. However, in a number of cases, the data requirements of RURALSIM exceeded the capabilities of Maine's system necessitating either manual compilation or the development of alternative methods to estimate demand. Neither the local providers, nor the local communities were willing to accept a more efficient and effective EMS delivery system if it meant giving up a certain amount of local autonomy and independence.

The Future of RURALSIM: Microcomputer Adaptation

RURALSIM can't be used directly by most rural EMS planners because it requires a mainframe computer. The costs associated with modeling also limit its use. The model is so complex that a single simulation could cost several hundred dollars. Since RURALSIM's development, rapid advancements in personal computers have occurred and RURALSIM's could be adapted to the microcomputer. Adapting the computer model to a microcomputer would allow rural areas with microcomputers to conduct their own simulations and work with the system interactively.

A microcomputer version could be simplified and used for the training/education of rural EMS planners and administrators. A number of different rural EMS scenarios could be developed which the "planner" could use to test-out possible alternative EMS improvements. The microcomputer-based model could also serve as a technical planning tool that could be incorporated into a technical assistance program.

Appendix C

Trauma Service Designation Guidelines of the American College of Surgeons and the American College of Emerging Physicians

Hospital and Prehospital Resources for Optimal Care of the Injured Patient by the Committee on Trauma of the American College of Surgeons

This report was prepared by the Task Force of the Committee on Trauma of the American College of Surgeons (ACS). In June of 1986, the Board of regents of the American College of Surgeons approved this report and authorized its publication as an official College document.

It is generally recognized that this document is a set of guidelines representing current thinking for optimal care of the injured. Further revisions may be indicated as systems are developed to meet the complex demands of severely injured patients.

Levels of Care

The three levels of care suggested in this document represent the best possible use of community resources. The organization of trauma services within the community or region must address the development of a good prehospital system. The concept of taking the severely injured patient to the nearest hospital is no longer acceptable.

Levels I and II—Invariably, in planning for regional trauma needs, physicians, administrators, and health planners must address how many hospitals should be designated. Factors that must be considered include maintenance of skills and experience, costs, population density, and geography. The following guidelines are offered to assist in this planning. General surgeons in Level I centers might be considered to have adequate experience in trauma surgery if they treat approximately 50 severe and urgent injury cases per year. Based on the number of surgeons in each institution, this will translate into 600 to 1,000 patients treated in a Level I hospital, and 350 to 600 patients treated in a Level II hospital. Since each community must decide on the number of appropriate trauma facilities necessary to meet its commitment to excellence in trauma care, it must consider the number of severe and urgent injuries to be handled as well as its ability to address its factors of geography and its ability to concentrate its resources.

Level III—The Level II hospital generally serves communities that do not have all the resources usually associated with Level-I or II institutions. However, as the following tables show, a Level III hospital reflects a *maximum commitment* to trauma care *commensurate* with resources. Planning for care of the injured in small communities or suburban settings usually calls for transfer agreements and protocols for the most severely injured. Designation of the Level III hospital may also require innovate use of the region's resources. For example, if there is no neurosurgeon in a large, sparsely populated region it may require that a general surgeon be prepared to provide the emergency decompression of mass lesions. Transfer to the most appropriate Level I or II hospital can then be arranged after the patient's life saving operation has been carried out. Another example is the staffing of the Level III hospital. In many instances it will be impractical to require a general surgeon to be in-house. With modern communication systems it seems reasonable that the surgeon should be promptly available and in a great majority of instance meet the patient in the emergency room on arrival. On-call personnel such as laboratory, x-ray, and operating room nurses also can be activated and respond promptly to the hospital when the first notification of a critically injured patient is received. The intent of this flexibility should be clear: to provide the best possible care even in the most remove circumstances.

The following table shows levels of categorization and their essential (E) or desirable (D) characteristics.

	LEVELS I	II	III
A. HOSPITAL ORGANIZATION			
1. Trauma Service	E	E	E
a) Specified delineation of privileges for the Trauma Service must be made by the medical staff Credentialing Committee.			
b) Trauma team — organized and directed by a general surgeon expert in and committed to care of the injured, all patients with multiple-system or major injury must be initially evaluated by the trauma team, and the surgeon who will be responsible for overall care of a patient (the team leader) identified. A team approach is required for optimal care of patients with multiple-system injuries. (See Appendix A, on page 11.)			
2. Surgery Departments/Divisions/Services/Sections *(each staffed by qualified specialists)*			
Cardiothoracic Surgery	E	D	
General Surgery	E	E	E
Neurologic Surgery	E	E	
Obstetrics-Gynecologic Surgery	D	D	
Ophthalmic Surgery	E	D	
Oral Surgery – Dental	D	D	
Orthopaedic Surgery	E	E	
Otorhinolaryngologic Surgery	E	D	
Pediatric Surgery	E	D	
Plastic and Maxillofacial Surgery	E	D	
Urologic Surgery	E	D	
3. Emergency Department/Division/Service/Section *(staffed by qualified specialists) (see note 1)*	E	E	E
4. Surgical Specialties Availability *(see note 2)* In-house 24 hours a day:			
General Surgery	E	E[3]	
Neurologic Surgery	E[4]	E[4]	

NOTES:

1. *The emergency department staff should ensure immediate and appropriate care for the trauma patient. The emergency department physician should function as a designated member of the trauma team and the relationship between emergency department physicians and other participants of the trauma team must be established on a local level, consistent with resources but adhering to established standards and ensuring optimal care.*

2. *Requirements may be fulfilled by senior residents capable of assessing emergent situations in their respective specialties. They must be capable of providing surgical treatment immediately and to provide the control and surgical leadership for the care of the trauma patient. When residents are used to fulfill availability requirements, staff specialists must be on-call and promptly available.*

SOURCE: The American College of Surgeons, Hospital and Prehospital Resources for Optimal Care of the Injured Patient, 1987.

SURGICAL SPECIALTIES continued	LEVELS I	II	III
On-call and promptly available from inside or outside hospital:			
Cardiac Surgery	E	D	
General Surgery			E
Neurologic Surgery			D
Microsurgery Capabilities	E	D	
Gynecologic Surgery	E	D	
Hand Surgery	E	D	
Ophthalmic Surgery	E	E	D
Oral Surgery (dental)	E	D	
Orthopaedic Surgery	E	E	D
Otorhinolaryngologic Surgery	E	E	D
Pediatric Surgery	E	D	
Plastic and Maxillofacial Surgery	E	E	D
Thoracic Surgery	E	E	D
Urologic Surgery	E	E	D
5. Non-Surgical Specialties Availability			
In-hospital 24 hours a day:			
Emergency Medicine	E[5]	E[5]	E
Anesthesiology	E[6]	E[6,7]	E[7]
On-call and promptly available from inside or outside hospital:			
Cardiology	E	E	D

NOTES:

3. The established trauma system should ideally ensure that the trauma surgeon will be present in the emergency department at the time of the patient's arrival. When sufficient prior notification has not been possible, a designated member of the trauma team will immediately initiate the evaluation and resuscitation. Definitive surgical care must be instituted by the trauma surgeon in a timely manner that is consistent with established standards.

4. An attending neurosurgeon must be promptly available and dedicated to that hospital's trauma service. The in-house requirement may be fulfilled by an in-house neurosurgeon or surgeon (or physician in Level II facilities) who has special competence, as judged by the chief of neurosurgery, in the care of patients with neural trauma, and who is capable of initiating measures directed toward stabilizing the patient and initiating diagnostic procedures.

5. In Level I and Level II institutions, requirements may be fulfilled by senior level emergency medicine residents capable of assessing emergency situations in trauma patients and providing any indicated treatment. When residents are used to fulfill availability requirements, the staff specialist on call will be advised and be promptly available.

6. Requirements may be fulfilled by anesthesiology residents capable of assessing emergent situations in trauma patients and of providing any indicated treatment. When anesthesiology residents are used to fulfill availability requirements, the staff anesthesiologist on call will be advised and available promptly.

7. Requirements may be fulfilled when local conditions assure that the staff anesthesiologist will be in the hospital at the time or shortly after the patient's arrival in the hospital. During the interim period, prior to the arrival of the staff anesthesiologist, a certified nurse anesthetist (CRNA) capable of assessing emergent situations in trauma patients and of initiating and providing any indicated treatment will be available.

Chest Medicine	E	D	
Gastroenterology	E	D	
Hematology	E	E	D
Infectious Diseases	E	D	
Internal Medicine	E	E	E
Nephrology	E	E	D
Neuroradiology	D		
Pathology	E	E	D
Pediatrics	E	E	D
Psychiatry	E	D	
Radiology	E	E	D

B. SPECIAL FACILITIES/RESOURCES/CAPABILITIES

1. Emergency Department (ED)

a) Personnel

1. Designated physician director	E	E	E
2. Physician with special competence in care of the critically injured who is a designated member of the trauma team and physically present in the ED 24 hours a day	E	E	E
3. RNs, LPNs, and nurses' aides in adequate numbers	E	E	E

b) Equipment for resuscitation and to provide life support for the critically or seriously injured shall include but not be limited to:

1. Airway control and ventilation equipment including laryngoscopes and endotracheal tubes of all sizes, bag-mask resuscitator, pocket masks, oxygen, and mechanical ventilator	E	E	E
2. Suction devices	E	E	E
3. Electrocardiograph-oscilloscope-defibrillator	E	E	E
4. Apparatus to establish central venous pressure monitoring	E	E	E
5. All standard intravenous fluids and administration devices, including intravenous catheters	E	E	E
6. Sterile surgical sets for procedures standard for ED, such as thoracostomy, cut-down, etc.	E	E	E
7. Gastric lavage equipment	E	E	E
8. Drugs and supplies necessary for emergency care	E	E	E
9. X-ray capability, 24-hour coverage by in-house technician	E	E	E
10. Two-way radio linked with vehicles of emergency transport system	E	E	E
11. Skeletal traction device for cervical injuries	E	E	E

	LEVELS I	II	III
2. Intensive Care Units (ICUs) for Trauma Patients ICUs may be separate specialty units.			
a) Designated medical director	E	E	E
b) Physician on duty in ICU 24 hours a day or immediately available from in-hospital	E	E	D
c) Nurse-patient minimum ratio of 1:2 on each shift	E	E	E
d) Immediate access to clinical laboratory services	E	E	E
e) Equipment:			
1. Airway control and ventilation devices	E	E	E
2. Oxygen source with concentration controls	E	E	E
3. Cardiac emergency cart	E	E	E
4. Temporary transvenous pacemaker	E	E	E
5. Electrocardiograph-oscilloscope-defibrillator	E	E	E
6. Cardiac output monitoring	E	E	D
7. Electronic pressure monitoring	E	E	D
8. Mechanical ventilator-respirators	E	E	E
9. Patient weighing devices	E	E	E
10. Pulmonary function measuring devices	E	E	E
11. Temperature control devices	E	E	E
12. Drugs, intravenous fluids, and supplies	E	E	E
13. Intracranial pressure monitoring devices	E	E	D
3. Postanesthetic Recovery Room (surgical intensive care unit is acceptable)			
a) Registered nurses and other essential personnel 24 hours a day	E	E	E
b) Appropriate monitoring and resuscitation equipment	E	E	E
4. Acute Hemodialysis Capability (or transfer agreement)	E	D	D
5. Organized Burn Care	E	E	E
a) Physician-directed burn center staffed by nursing personnel trained in burn care and equipped properly for care of the extensively burned patient, **OR**			
b) Transfer agreement with nearby burn center or hospital with a burn unit			
6. Acute Spinal Cord/Head Injury Management Capability	E	E	E
a) In circumstances where a designated spinal cord injury rehabilitation center exists in the region, early transfer should be considered;			

	transfer agreements should be in effect b) In circumstances where a head injury center exists in the region, transfer should be considered in selected patients; transfer agreements should be in effect			
7.	**Radiological Special Capabilities**			
	a) Angiography of all types	E	E	D
	b) Sonography	E	D	
	c) Nuclear scanning	E	D	
	d) In-house computerized tomography with technician	E	E	
8.	**Rehabilitation Medicine** a) Physician-directed rehabilitation service staffed by nursing personnel trained in rehabilitation care and equipped properly for care of the critically injured patient, **OR** b) Transfer agreement when medically feasible to a nearby rehabilitation service	E	E	E
C.	**OPERATING SUITE SPECIAL REQUIREMENTS**			
	Equipment-Instrumentation			
1.	Operating room adequately staffed in-house and immediately available 24 hours a day	E	E	D
2.	Cardiopulmonary bypass capability	E	D	
3.	Operating microscope	E	D	
4.	Thermal control equipment: a) for patient	E	E	E
	b) for blood	E	E	E
5.	X-ray capability	E	E	E
6.	Endoscopes, all varieties	E	E	E
7.	Craniotome	E	E	D
8.	Monitoring equipment	E	E	E
D.	**CLINICAL LABORATORY SERVICE** *(available 24 hours a day)*			
1.	Standard analyses of blood, urine, and other body fluids	E	E	E
2.	Blood typing and cross-matching	E	E	E
3.	Coagulation studies	E	E	E
4.	Comprehensive blood bank or access to a community central blood bank and adequate hospital storage facilities	E	E	E
5.	Blood gases and pH determinations	E	E	E

		LEVELS I	II	III
6.	Serum and urine osmolality	E	E	D*
7.	Microbiology	E	E	E
8.	Drug and alcohol screening	E	E	D*

**Toxicology screens need not be immediately available but are desirable. If not available, results should be included in all quality assurance reviews.*

E.	**QUALITY ASSURANCE**			
1.	Organized Quality Assurance Program	E	E	E
2.	Special audit for all trauma deaths and other specified cases (see Appendix G on page 42)	E	E	E
3.	Morbidity and mortality review	E	E	E
4.	Trauma conference, multidisciplinary (see note 8)	E	E	
5.	Medical nursing audit, utilization review, tissue review	E	E	E
6.	Trauma registry review (see note 9)	E	E	E
7.	Review of prehospital and regional systems of trauma care	E	D	D
F.	**OUTREACH PROGRAM** Telephone and on-site consultations with physicians of the community and outlying areas	E	D	
G.	**PUBLIC EDUCATION** Injury prevention in the home and industry, and on the highways and athletic fields; standard first-aid; problems confronting public, medical profession, and hospitals regarding optimal care for the injured	E	E	D
H.	**TRAUMA RESEARCH PROGRAM**	E	D	D
I.	**TRAINING PROGRAM**			
1.	**Formal programs in continuing education provided by hospital for:**			
a)	Staff physicians	E	E	D
b)	Nurses	E	E	D
c)	Allied health personnel	E	E	D
d)	Community physicians	E	E	D

NOTES:

8. Regular and periodic multidisciplinary trauma conferences that include all members of the trauma team should be held. This conference will be for the purpose of quality assurance through critiques of individual cases.

9. Documentation of severity of injury (by trauma score, age, injury severity score) and outcome (survival, length of stay, ICU length of stay) with monthly review of statistics.

Guidelines for Trauma Care Systems

[These guidelines were developed by the American College of Emergency Physicians Trauma Committee and were approved for publication by the Board of Directors on September 18, 1986. These guidelines supersede the previous position statement on trauma care (February 1982;11:105). American College of Emergency Physicians: Guidelines for trauma care systems. Ann Emerg Med April 1987;16:459-463.]

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PREAMBLE

Trauma, defined as serious bodily injury, constitutes our most expensive yet correctable national health problem.[1] Trauma remains the leading cause of death for persons 1 to 37 years of age and the leading cause of disability for persons of all ages. The overall cost of accidental injury currently exceeds $90 billion annually.[2] Although some areas have already organized and integrated the emergency medical services (EMS) system components and providers that are essential to optimizing trauma care, others have failed to develop adequate trauma care systems or to acknowledge that such an approach is necessary.

The American College of Emergency Physicians has long maintained a commitment to the comprehensive care of ill and injured persons, including treatment, education, and research. The ability to respond appropriately to the needs of trauma victims requires the skills and efforts of the entire health care team. EMS systems should provide treatment for seriously injured patients in an organized and timely fashion. Trauma care is but one aspect of EMS, however, and special provisions for trauma victims should not be permitted to fragment the remainder of the emergency medical care system.

Trauma care represents a continuum that is best provided by an integrated system extending from prevention through rehabilitation and requiring close cooperation among specialists in each phase of care. A systems approach to trauma care acknowledges this continuum, improving quality and reducing mortality. Since 1976 the Committee on Trauma of the American College of Surgeons has periodically published guidelines describing resources for trauma care.[3] Because optimal treatment requires systems that encompass all aspects of care, however, the Trauma Committee of the American College of Emergency Physicians has developed these guidelines, which complement those of the American College of Surgeons by defining the components and providers that are essential to urban and rural trauma care systems (Figure).

Emergency physicians should provide leadership in trauma care, not only by developing and managing systems, but also by directing prehospital care, providing emergency department resuscitation and stabilization, and facilitating a smooth transition to inhospital care. The American College of Emergency Physicians recognizes that inhospital care for the seriously injured is best provided by facilities whose governing bodies, administrations, and medical staffs are committed to excellence in trauma care, and that definitive, long-term treatment is best provided by specialists who are specifically trained in trauma care.

The American College of Emergency Physicians encourages all medical providers to work together to afford optimal care to all injured persons in the most efficient manner possible. Such relationships between emergency physicians and other members of the trauma care team must be established

locally and cannot be mandated by the government or other parties. Individual systems are therefore encouraged to develop criteria that reflect local needs and resources.

These guidelines have been developed for the purpose of assisting regions to plan, implement, operate, and evaluate new and existing trauma care systems; they are not intended to be used for certification. Additionally, to continue defining and clarifying individual aspects of trauma care systems, the American College of Emergency Physicians will publish appendices to this document periodically.

GUIDELINES

Trauma care systems entail three dimensions, incorporating four providers and 11 components in two settings (Figure). The following section describes individual components as either essential (E) or desirable (D) for each provider in each setting.

Example		
I. Provider #1	Urban*	Rural†
A. Component #1	E	E
B. Component #2	E	D
C. Etc		

I. System Management	Urban	Rural
A. *Authority and Responsibility.* Each system should establish its authority commensurate with its responsibility to provide trauma care, seeking enabling legislation when required.	E	E
B. *Central Administrative Agency.* Each system should identify a broad-based group of providers and consumers that is ultimately responsible for system management.	E	E
1. Master plan for system development, including criteria for each component, to be used for planning, implementation, operation, and evaluation	E	E
a. Prehospital criteria,[3] including triage, treatment, and transportation	E	E
b. Hospital criteria,[3] including facility numbers and levels, patient volumes, and staff/equipment standards	E	E
2. Medical director, familiar with and experienced in EMS and trauma system care	E	E
3. Administrative staff, familiar with and experienced in EMS and trauma system management	E	E
4. Prevention/public education		
a. Public education programs	E	E
b. Legislative advocacy programs	E	E
5. Training		
a. Clinical training for prehospital providers[4]	E	E
b. System utilization information for community physicians, nurses, and prehospital providers	E	E
6. Communications		
a. Regional plan	E	E
b. 911 access	E	D
c. Central control for medical direction and dispatch, including appropriate training for dispatchers	E	D
d. Linkage development	E	E
e. Equipment procurement	D	D
7. Data collection		
a. Adequate personnel	E	E
b. System registry participation	E	E
8. Medical audit		
a. Staff with expertise in quality assurance, statistics, and computers	E	D
b. Equipment and storage	E	D
c. Criteria for evaluating the system and its components	E	E
d. Quality assurance program, including feedback loop for demonstrated problems	E	E
9. Transplantation program coordination for potential donors	E	E
C. *Certification and Decertification.* Each system should develop and implement policies and procedures for certifying and decertifying providers, including personnel, transportation, and facilities.	E	E
D. *Finance.* Each system should identify adequate resources, by line item, for planning,		

*System that encompasses at least one metropolitan area with 250,000 persons

†System lacking any single population center

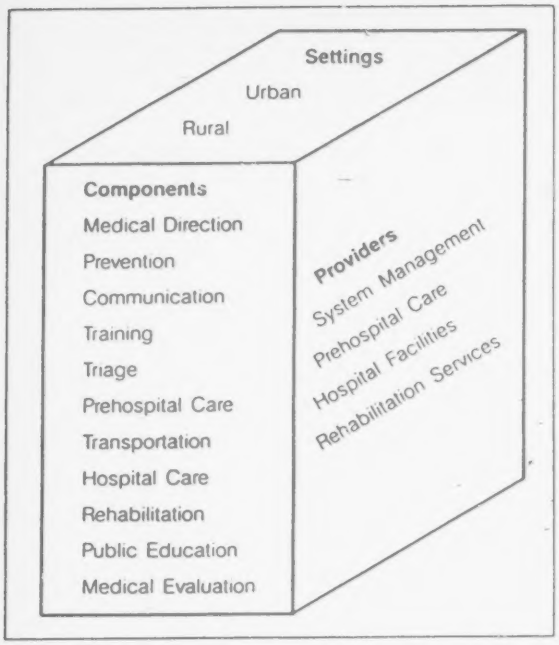

FIGURE. *Three dimensions of trauma care systems.*

	Urban	Rural
implementation, operation, and evaluation.	E	E
E. *Emergency/Disaster Preparedness.* Each system should develop a regional disaster plan that integrates EMS, trauma care, and disaster management system resources.	E	E
1. Regional plan for all providers	E	E
2. Central control through local emergency management association	D	D
II. Prehospital Care		
A. *Management Agency.* Each system should identify an agency that is ultimately responsible for prehospital care. In some instances this function may be fulfilled by the central administrative agency.	E	E
1. Administration		
a. Medical director, familiar with and experienced in prehospital care	E	E
b. Support staff, familiar with and experienced in prehospital management	E	E
2. Training		
a. Sufficient experienced staff	E	E
b. Curriculum[4] integrated with system	E	E
3. Criteria		
a. Protocols[3] integrated with system	E	E
4. Certification and decertification		
a. Consistent with state and local criteria	E	E
b. Standardized clinical examination	E	E
5. Data collection integrated with system	E	E
6. Medical audit integrated with system	E	E
B. *Ambulance Standards.* Each system should establish standards for land and air transportation, subject to legislative regulations.	E	E
1. Personnel	E	E
2. Equipment[3]	E	E
3. Process for ambulance certification and decertification	E	E
C. *Communication System.* Each system should develop a prehospital communication system that is fully integrated with the remainder of the EMS and emergency/disaster preparedness systems.	E	E
1. Central control for medical direction and dispatch	E	D
2. Equipment		
a. Minimize radio dead space	E	D
b. Equip all vehicles and aircraft	E	D
D. *Emergency/Disaster Preparedness Plan.* Each system should develop a prehospital emergency/disaster preparedness plan that is fully integrated with the remainder of the EMS system.	E	E
E. *Prevention/Public Education*		
1. Injury prevention	E	E
2. First aid and CPR	E	E
III. Hospital Facilities		
A. *Trauma Hospitals.* Each system should identify an appropriate number of trauma hospitals to provide immediately available surgical care for seriously injured patients.	E	E

	Urban	Rural
1. Standards[3]		
a. Emergency department	E	E
b. Surgery department	E	E
c. Nursing care	E	E
d. Laboratory/blood bank/ x-ray	E	E
e. Computerized axial tomography	E	D
f. Trauma nurse coordinator	E	E
g. Treatment protocols	E	E
h. Integrated with EMS system	E	E
i. Documented institutional commitment	E	E
j. Current JCAH accreditation	E	E
2. Communication		
a. Integrated with EMS system	E	E
b. Base station hospital	D	D
3. Helicopter landing capability		
a. On-site	E	D
b. Licensed by regulatory authority	E	E
4. Continuing medical education		
a. Physicians	E	D
b. Nurses	E	D
c. Prehospital providers	E	E
5. Protocols		
a. Prehospital bypass/ rerouting, coordinated with other trauma hospitals through the central administrative agency	E	E
b. Treatment[3]	E	E
c. Transfer,[3] for all incoming patients regardless of origin	E	E
6. Prevention/public education		
a. Community-based programs	E	E
7. Data collection		
a. Adequate personnel	E	E
b. Hospital registry	E	E
c. System registry participation	E	E
8. Rehabilitation		
a. (See Section IV)	E	E
9. Medical audit		
a. Adequate personnel	E	E
b. Quality assurance program, including feedback loop for demonstrated problems	E	E
10. Emergency/disaster preparedness plan		
a. Internal plan	E	E
b. Integrated with remainder of emergency/disaster preparedness system	E	E
B. *Specialty Care Hospitals.* Each system should additionally identify specialty care hospitals for the small proportion of patients requiring such treatment. Access preferably entails prehospital transport, but also includes interhospital transfer when medically appropriate. If adequate facilities do not exist in the area, formal transfer agreements should be developed with nearby resources.	E	E
1. Standards		
a. Pediatric trauma[3]	E	D
b. Burns[3]	E	D
c. Spinal cord trauma[5]	E	D
d. Hand trauma/limb replantation	E	D
e. Eye trauma	E	D
2. Current JCAH accreditation	E	E
3. Communication		
a. Integrated with EMS system	E	E
4. Helicopter landing capability		
a. On-site	D	D
b. Licensed by regulatory authority	E	E
5. Training		
a. Physicians	E	D
b. Nurses	E	D
c. Prehospital providers	E	D
6. Protocols		
a. Prehospital bypass/ rerouting, coordinated with other trauma hospitals through the central administrative agency	E	E
b. Treatment[3]	E	E
c. Transfer,[3] for all incoming patients regardless of origin	E	E
7. Prevention/public education		
a. Community-based programs	E	E

	Urban	Rural
8. Data collection		
a. Adequate personnel	E	E
b. Hospital registry	E	E
c. System registry participation	E	E
9. Rehabilitation a. (See Section IV)	E	E
10. Medical audit		
a. Adequate personnel	E	E
b. Quality assurance program, including feedback loop for demonstrated problems	E	E
11. Emergency/disaster preparedness plan		
a. Internal plan	E	E
b. Integrated with remainder of emergency/disaster preparedness system	E	E
IV. Rehabilitation		
Rehabilitation planning, which should start with emergency department admission, may continue after hospital transfer or discharge. If adequate facilities do not exist in the area, formal transfer agreements should be developed with nearby resources.	E	E
A. *Special Care Facility*		
1. Medical direction	E	E
2. Adequate staffing	E	E
a. Nursing care	E	E
b. Physical therapy	E	D
c. Occupational therapy	E	D
d. Psychosocial/substance abuse counseling	E	D
e. Family support services	E	D
f. Patient support groups	E	D
g. Orthotic/prosthetic services	E	D
h. Speech/language/hearing services	E	D
B. *Noninstitutional Care*		
1. Medical direction	E	E
2. Adequate staffing	E	E
a. Nursing care	E	E
b. Physical therapy	E	D
c. Occupational therapy	E	D
d. Psychosocial/substance abuse counseling	E	D
e. Family support services	E	D
f. Patient support groups	E	D
g. Orthotic/prosthetic services	E	D
h. Speech/language/hearing services	E	D
C. *Financial Support.* Each system should identify adequate resources for rehabilitation.	E	E
D. *Data Collection*		
1. Adequate personnel	E	E
2. Provider registry	E	E
3. System registry participation	E	E
E. *Medical Audit*		
1. Adequate personnel	E	E
2. Coordinate with system audit	E	E
3. Quality assurance program, including feedback loop for demonstrated problems	E	E

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Appendix D

Oregon Trauma Systems Summary and Hospital Resource Criteria

OREGON TRAUMA SYSTEM SUMMARY

Emergency Medical Services Section
State Health Division
OCTOBER 1989

In 1985 the Oregon Legislature authorized the Oregon State Health Division to implement a state wide trauma system, The following is a description of our activities, progress to date, and a brief characterization of the impact these activities are having on the care of patients with serious traumatic injuries.

The Plan

Approximately 1,300 Oregonians die each year and many more are permanently disabled by serious injuries. A trauma system reduces death and disability by (1) identifying the causes of injury and promoting activities to prevent injury from occurring and (2) assuring that appropriate emergency medical resources are used effectively and efficiently, The Health Division emphasizes local planning, prevention of injuries and strengthening of prehospital care in the following ways:

A State Trauma Advisory Board, consisting of the multi-disciplinary members of the medical team and members of the public, was appointed to help develop standards and policies for the trauma system and to serve as a liaison between state and local planners.

Ten trauma areas were established statewide reflecting current patient referral patterns, resources and geography. In each area an Area Trauma Advisory Board was appointed to develop the area trauma plan which coordinates the response, care and transportation of the patient. There are 157 volunteers on Area Trauma Advisory Boards statewide.

Area Trauma System Plans are in various stages of development and the Health Division is categorizing or designating trauma hospitals statewide in accordance with standards modified from the American College of Surgeons Hospital Resource criteria, Oregon is the first state in the nation to develop standards which recognize and include rural hospitals, This assures that patients throughout the state receive care consistent with national standards. Completion of categorization and designation of trauma hospitals and adoption of area trauma plans is targeted for completion by August 1990.

> A statewide information system or "injury registry" will gather data about causes of injury, the emergency response and the patient outcome. In addition to evaluating the trauma system for quality assurance, this data will provide information for prevention of injuries.

The Health Division is implementing an injury prevention program which will use the injury data to develop and implement prevention strategies which focus on problems specific to Oregon. This program will provide technical assistance to help local programs implement effective interventions.

> The Health Division has conducted a major pediatric trauma project in an effort to improve the emergency medical response specifically for seriously ill and injured children.

Progress to Date

The overriding concern both when this bill was passed and since, has been that the trauma system must meet the diverse needs of Oregon. To address this concern the Health Division held informational meetings in 21 cities to obtain input about emergency medical services problems and to encourage interest in local planning. In response, 325 emergency providers applied to serve on our advisory board (map attached).

During the past four years the 157 appointed members of the advisory boards have been helping to assure that statewide goals, standard and procedures for the trauma system are appropriate. With the help of the state trauma advisory board, state staff negotiated compromises among the various recommendations. The results of this input and discussion have been incorporated in the Trauma System Rules, filed in February 1987, which establish the minimum standards for area plans covering the prehospital care interhospital transfer, and quality assurance, as well as the procedures for hospital categorization and designation.

A Trauma System Resource Guide was developed which describes goals and guidelines of the trauma system and assists the area trauma advisory boards with their trauma system planning efforts, Another document, a request-for-proposal, assists hospitals in developing their trauma services and prepares them for verification surveys.

Current Activities

Each area trauma advisory board has been writing an area trauma system plan which is due in three phases. The plan for Area 1 (the seven northwest counties of Oregon) has been completed and was implemented May 2, 1988. The state board is providing assistance and review to assure that area plans meet state standards. In the

meantime, the Health Division staff are organizing visits by teams of experts to all hospitals. This process of categorization and designation assures that patients are treated in hospitals with a high commitment to trauma care regardless of hospital size and location.

Within Area #1 (see map attached) two level I trauma hospitals have been designated in Portland, consistent with the recommendations set forth by the providers in the area trauma system plan. In the surrounding counties, three level III & IV trauma hospitals were designated, Since the trauma system was implemented in May 1988, the area board has been working with the Health Division to develop and implement a model quality assurance program for the continual monitoring and evaluation of the trauma system.

In Areas #7, #9, and #10 (most of Central and Eastern Oregon) the first part of the area trauma system plans have been approved and are being implemented, Fifteen hospitals serving these areas were surveyed in November 1988 by teams of out-of-state trauma experts and were categorized as trauma hospitals.

The remaining trauma areas (Areas #2, #3, #4, #5, #6 and #8) are in various stages of trauma system plan development.

The State Trauma Advisory Board is focusing on developing quality assurance activities, evaluating the rural hospital resource criteria, and continuing to assist Area Trauma Advisory Boards with trauma plan development.

Impact on Patient Care

In some areas, the trauma planning process has provided a useful forum for amicable problem solving. The emergency medical service providers are working out problems and upgrading the quality of care through training and improved coordination. In other areas, the trauma board is providing the forum for heated but fair resolution of long-standing controversies. The providers are compromising on their preferred approaches to a trauma system. A few boards are struggling with what often seem to be insurmountable problems and inadequate resources. Progress is slow in these areas, In the area that has an implemented system hospitals are reporting excellent spin-off effects to non-trauma services as a result of developing their trauma service. Providers report that patients are receiving care that is more consistently in keeping with the goals for rapid definitive care. In all areas of the state, the development of the trauma system is being tackled by the appropriate people -- the providers who have to implement it and the public who will be served by it. We expect to meet a 1990 deadline for a system to improve care for all trauma patients.

HOSPITAL RESOURCE CRITERIA

EXHIBIT III
(333-200-080)

The following table shows levels of categorization and their essential "E" (mandatory) or desirable "D" characteristics.

	LEVELS			
	Community (IV)	Local (III)	Area (II)	Regional (I)
A. HOSPITAL ORGANIZATION-				
1. Trauma Service		E	E	E
a) Specified delineation of privileges for the Trauma Service must occur by the medical staff Credentialing Committee.				
b) Trauma Team - organized and directed by a general surgeon expert in and committed to care of the injured, all patients with multiple system or major injury must be initially evaluated by the trauma team, and the surgeon who will be responsible for overall care of a patient (the team leader) identified. A team approach is required for optimal care of patients with multiple-system injuries.				
2. Surgery Departments/ Divisions/ Services/Sections (each staffed by qualified specialists)				
Cardiothoracic Surgery			D	E
General Surgery	D	E	E	E
Neurologic Surgery			E	E
Obstetrics-Gynecologic Surgery			D	E
Ophthalmic Surgery			D	E
Oral Surgery - Dental			D	D
Orthopaedic Surgery			E	E
Otorhinolaryngologic Surgery			D	E
Pediatric Surgery			D	E
Plastic and Maxillofacial Surgery			D	E
Urologic Surgery			D	E
3. Emergency Department/Division/ Service/Section	E	E	E	E
Staffed by qualified specialists: The emergency department staffing shall ensure immediate and appropriate care for the trauma patient. The emergency department physician shall function as a designated member of the trauma team, and the relationship between emergency department physicians and other participants of the trauma team must be established on a local level, consistent with resources but adhering to these standards and ensuring optimal care.				
4. Surgical Specialty Capability Availability				
(a) General Surgery	D	D	E	E
Board Certified (May be a surgeon who is a graduate of an A.C.G.M.E. approved residency and who is less than five (5) years out of training. If the surgeon fails to obtain board certification within five (5) years, s/he is no longer eligible, even though s/he has obtained ATLS course completion.				
Full, unrestricted general surgery privileges.	D	E	E	E
ATLS	E	E	E	E
On call and promptly available.		E		

	On call and immediately available to patient on arrival in emergency department. (Assumes 15 minute prehospital notification.)		E	
	In-house and immediately available to patient on arrival in emergency department. (Assumes 5 minute prehospital notification.)			E
(b)	Neurologic Surgery			
	Full, unrestricted neurosurgery privileges. On call and promptly available.	D	E	E
	Physician with special competence, as judged by the Chief of Neurosurgery, in the care of patients with neural trauma, and who is capable of initiating measures directed toward stabilizing the patient and initiating diagnostic procedures. In-house and immediately available.		E	E
(c)	Cardiac Surgery On call and promptly available.		D	E
(d)	Microsurgery Capabilities Promptly available		D	E
(e)	Gynecologic Surgery On call and promptly available.		D	E
(f)	Hand Surgery On call and promptly available.		D	E
(g)	Ophthalmic Surgery On call and promptly available.	D	E	E

(h)	Oral Surgery (Dental) On call and promptly available.			D	E
(i)	Orthopaedic Surgery On call and promptly available.	D	D	E	E
(j)	Otorhinolaryngologic Surgery On call and promptly available.		D	E	E
(k)	Pediatric Surgery On call and promptly available.			D	E
(l)	Plastic and Maxillofacial Surgery. On call and promptly available.		D	E	E
(m)	Thoracic Surgery On call and promptly available.		D	E	E
(n)	Urologic Surgery On call and promptly available.		D	E	E
5.	Non-Surgical Specialty Capability Availability				
(a)	Anesthesiology				
	Anesthesiologist Full, unrestricted anesthesiology privileges.	D	D	E	E
	ATLS and ACLS	D	D	D	D
	Certified Registered Nurse Anesthetist Current national certification essential.				
	ACLS and a trauma life support course.	D	D	D	D

(j) Pathology On call and promptly available.		D	E	E
(k) Pediatrics On call and promptly available.		D	E	E
(l) Psychiatry On call and promptly available.			D	E
(m) Radiology On call and promptly available.	D	D	E	E

B. SPECIAL FACILITIES/RESOURCES/ CAPABILITIES

1. Emergency Department

(a) Personnel

1. Designated Physician Director	D	E	E	E
2. Emergency Physician				
Full-time emergency medicine practitioner with special competence in care of the critically injured.	D	D	E	E
Physicians who are qualified and experienced in caring for patients with traumatic injuries and who can initiate resuscitative measures.	E	E		
ATLS	E	E	E	E
ACLS	D	E	E	E
In-house and immediately available to patient on arrival in emergency department.	D	E	E	E
On call and promptly available.	E			
Anesthesiologist In-house and immediately available to patient on arrival in emergency department (Assumes 5 minute prehospital notification.)				E
Anesthesiologist On-call and immediately available to patient on arrival in operating room. (Assumes 15 minute pre-hospital notification.)			E	
On call and promptly available anesthesiologist or on call and promptly available Certified Registered Nurse Anesthetist.	E	E		
(b) Cardiology On call and promptly available.		D	E	E
(c) Chest Medicine On call and promptly available.			D	E
(d) Gastroenterology On call and promptly available.			D	E
(e) Hematology On call and promptly available.		D	E	E
(f) Infectious Diseases On call and promptly available.			D	E
(g) Internal Medicine On call and promptly available.		E	E	E
(h) Nephrology On call and promptly available.		D	E	E
(i) Neuroradiology On call and promptly available.				D

3.	Emergency Department Registered Nurse				
	ACLS	E	E	E	E
	A trauma life support course.	D	D	E	E
	In Emergency Department and immediately available.	D	E	E	E
	In-house and immediately available.	E			
b.	Equipment for resuscitation and to provide life support for the critically or seriously injured shall include but not be limited to:				
1.	Airway control and ventilation equipment including laryngoscopes and endotracheal tubes of all sizes, bag-mask resuscitator, sources of oxygen and mechanical ventilator	E	E	E	E
2.	Suction devices	E	E	E	E
3.	Electrocardiograph-oscilloscope-defibrillator	E	E	E	E
4.	Apparatus to establish central venous pressure monitoring	E	E	E	E
5.	All standard intravenous fluids and administration devices, including intravenous catheters	E	E	E	E

6.	Sterile surgical sets for procedures standard for ED such as thoracostomy cut-down etc.	E	E	E	E
7.	Gastric lavage equipment	E	E	E	E
8.	Drugs and supplies necessary for emergency care	E	E	E	E
9a.	X-ray capability 24 hour coverage by in-house technicians	D	D	E	E
b.	Technician on-call and promptly available to patient on arrival in emergency department	D	E		
10.	Two-way radio linked with vehicles of emergency transport system	E	E	E	E
11.	Pneumatic Anti-Shock Garment	E	E	E	E
12.	Skeletal Traction device for cervical injuries	E	E	E	E
2.	Intensive Care Units (ICU) for Trauma Patients ICUs may be separate specialty units				
a)	Designated Medical Director		E	E	E
b)	Physician on duty in ICU 24 hours a day or immediately available		D	E	E
c)	Nurse-patient minimum ratio of 1:2 on shift		E	E	E

d) Immediate access to clinical laboratory services	E	E	E	
e) Equipment:				
1. Airway control and ventilation devices	E	E	E	
2. Oxygen source with concentration controls	E	E	E	
3. Cardiac emergency cart	E	E	E	
4. Temporary transvenous pacemaker	E	E	E	
5. Electrocardiograph-oscilloscope-defibrillator	E	E	E	
6. Cardiac output monitoring	D	E	E	
7. Electronic pressure monitoring	D	E	E	
8. Mechanical ventilator-respirators	E	E	E	
9. Patient weighing devices	E	E	E	
10. Pulmonary function measuring devices	E	E	E	
11. Temperature control devices	E	E	E	
12. Drugs, intravenous fluids and supplies	E	E	E	
13. Intracranial pressure monitoring devices	D	E	E	
3. Postanesthetic Recovery Room (PAR) (surgical intensive care unit is acceptable)				
a) Registered nurses and other essential personnel 24 hours a day	D	E	E	E
b) Appropriate monitoring and resuscitation equipment	D	E	E	E
4. Acute Hemodialysis Capability (or transfer agreement)		D	D	E
5. Organized Burn Care	E	E	E	E
a) Physician-directed Burn Center Unit staffed by nursing personnel trained in burn care and equipped properly for care of the extensively burned patient. OR				
b) Transfer agreement with nearby burn center or hospital with a burn unit.				
6. Acute Spinal Cord Injury Management Capability	E	E	E	E
a) In circumstances where a designated spinal cord injury rehabilitation center exists in the region, early transfer should be considered; transfer agreements should be in effect.				
b) In circumstances where a head injury center exists in the region, transfer should be considered in selected patients; transfer agreements should be in effect.				
7. Radiological Special Capabilities				
a) Angiography of all types		D	E	E
b) Sonography			D	E
c) Nuclear scanning			D	E

d)	In-house computerized tomography.			E	E
	In-house technician			D	E
	Technician on call and promptly available.			E	
B.	Rehabilitation Medicine	E	E	E	E
a)	Physician-directed Rehabilitation Service staffed by nursing personnel trained in rehabilitation care and equipped properly for care of the critically injured patient, OR				
b)	Transfer agreement when medically feasible to a nearby rehabilitation service.				
C.	Operating Suite Special Requirements				
	Equipment-instrumentation				
1.	Operating Room adequately staffed and equipped for trauma care.				
	Promptly available.	E	E		
	Immediately available to patient on arrival in Operating Room or when requested by surgeon. (May be satisfied by one RN in-house and immediately available to the Operating Suite with the remainder of the crew on call and promptly available.)			E	
	In-house staff and Operating Room immediately available to patient on arrival in emergency department. (Assumes 5 minute pre-hospital notification.				E
2.	Cardiopulmonary bypass capability			D	E
3.	Operating microscope			D	E
4.	Thermal control equipment:				
a.	for patient	E	E	E	E
b.	for blood	E	E	E	E
5.	X-Ray capability	E	E	E	E
6.	Endoscopes	D	E	E	E
7.	Craniotome	D	D	E	E
8.	Monitoring Equipment	E	E	E	E
D.	Clinical Laboratories Services available 24 hours a day				
1.	Standard analyses of blood, urine and other body fluids	E	E	E	E
2.	Blood typing and cross-matching	E	E	E	E
3.	Coagulation studies	E	E	E	E
4.	Comprehensive blood bank or access to a community central blood bank and adequate hospital storage facilities	E	E	E	E
5.	Blood gases and pH determinations	E	E	E	E
6.	Serum and urine osmolality	D	D	E	E
7.	Microbiology	E	E	E	E
8.	Serum alcohol determination	E	E	E	E
9.	Drug Screening	D	D	E	E

E. Quality Assurance

1.	Organized Quality Assurance Program	E	E	E
2.	Special audit for all trauma deaths and other specified cases	E	E	E
3.	Morbidity and mortality review	E	E	E
4.	Trauma conference, multidisciplinary		E	E
	Regular and periodic multidisciplinary trauma conferences that include all members of the trauma team. This conference will be for the purpose of quality assurance through critiques of individual cases.			
5.	Medical nursing audit, utilization review, tissue review	E	E	E
6.	Trauma registry review	E	E	E
	Documentation of severity of injury and outcome by trauma score, age, injury severity score, TRISS, survival, length of stay, ICU length of stay with monthly review of statistics.			
	Full participation in the Division Trauma Registry and quality assurance activities as prescribed in the area plan.	E	E	E
	Designated Trauma Registry Coordinator	E	E	E
7.	Review of prehospital and regional systems of trauma care	D	D	E

F.	Outreach Program: Telephone and on-site consultations with physicians of the community and outlying areas.		D	E

G.	Public Education: injury prevention in the home and industry, and on the highways and athletic fields; standard first-aid; problems confronting public, medical profession, and hospitals regarding optimal care for the injured.	D	D	E	E
H.	Trauma Research Program		D	D	E
I.	Training Program				
1.	Formal program continuing education provided by hospital for:				
	a) Staff physicians	D	D	E	E
	b) Nurses	D	D	E	E
	c) Allied health personnel	D	D	E	E
	d) Community physicians	D	D	E	E
	e) Prehospital personnel	D	D	E	E
2.	Accredited general surgery residency program.				E

Appendix E

Trauma Care/EMS Legislation Introduced During the 101st Congressional Session

S.15—Emergency Medical Services and Trauma Care Improvement Act of 1989 (C101) 01/25/89

Sen. Cranston (Cosp=23)
Senate Labor and Human Resources

DIGEST AS INTRODUCED:

Emergency Medical Services and Trauma Care Improvement Act of 1989—Amends the Public Health Service Act to create a new title on trauma care. Directs the Secretary of Health and Human Services to provide for the establishment and operation of a National Clearinghouse on Emergency Medical Services and Trauma Care. Authorizes appropriations for FY 1990 through 1992 or for the first three fiscal years for which funds are appropriated. Authorizes the Secretary to make grants and enter into cooperative agreements and contracts with respect to emergency medical services and trauma care systems to: (1) conduct and support research, training, evaluations, and demonstration projects; (2) provide technical assistance to State and local agencies; and (3) establish guidelines for the development of uniform State data reporting systems.

Directs the Secretary to make an allotment for each State for each fiscal year, mandating that at least 35 percent, subject to adjustment, be used for planning, implementing, monitoring, and evaluating the operation of county, regional, or State trauma care systems. Sets forth requirements for such systems. Requires States to use at least 35 percent of the amount available to them for a fiscal year to reimburse designated trauma centers for uncompensated trauma care expenditures. Requires non-Federal matching contributions (in cash or in kind) in a specified ratio for fiscal years after FY 1990. Requires each State, for each fiscal year beginning with FY 1990, to submit the trauma care component of the State emergency medical services plan (State plan) to the Secretary. Sets forth requirements for the State plan. Requires that hospital emergency departments, within their capability, if an individual appears and requests examination and treatment: (1) examine for the existence of an emergency medical condition or active labor and, if such a condition or labor exists, treat the individual until stable, subject to exception; and (2) transfer such individual to other facilities only according to stated criteria. Requires States to adopt guidelines for the designation of trauma centers, and for triage, transfer, and transportation policies, at least as stringent as the applicable guidelines developed by the American College of Surgeons and by the American College of Emergency Physicians. Mandates that States: (1) require each trauma center to provide information to the State central data reporting system annually; (2) submit, to the Secretary at least annually, the information it receives from its data reporting and analysis system; and (3) identify and submit to the Secretary a list of rural areas lacking certain emergency medical services. Sets forth restrictions on the use of State allotments. Requires an annual report from each State to the Secretary. Sets forth a formula for determination of the amount of allotments. Provides for: (1) repayment and offset for failure to use funds as agreed; (2) criminal penalties for certain false statements; (3) technical assistance and provision of supplies and services by the Secretary in lieu of grant funds; and (4) a report by the Secretary to the Congress.

Authorizes appropriations for FY 1990 through 1992. Directs the Secretary of Health and Human Services to conduct studies: (1) to determine the adequacy and appropriateness of the reimbursements provided to trauma centers under Title XIX (Medicaid) of the Social Security Act; and (2) of the long-term economic effects of trauma. Amends the Public Health Service Act to revise the application procedure for Preventive Health and Health Services Block Grants to provide the State officer responsible for the administration of the State highway safety program an opportunity to participate in the development of any plan relating to emergency medical services as such plan relates to highway safety. Allows the State official responsible for the provision of emergency medical services the opportunity to participate in the development of the State highway safety program as such program relates to emergency medical services.

Amends the Public Health Service Act and the Consolidated Farm and Rural Development Act to allow certain grant allotments to be used for the purchase of communications equipment. Requires the Federal Communications Commission to: (1) study the availability of radio frequency channels for emergency medical services communications; (2) establish a plan to ensure that the needs of emergency medical services communications are provided for in the allocations of frequencies for public safety; and (3) submit a report to Committees of the Congress containing such study and plan.

S. Amdt. No. 378—Amendment to S.15 (C101) 07/20/89

Sen. Cranston (Acosp=9)
Senate Labor and Human Resources

CONG REC S8521

AMENDMENT DIGEST: FROM HOUSE OR SENATE

To provide funding to support emergency medical services in rural areas.

S.1274—Comprehensive and Uniform Remedy for the Health Care System Act of 1989 (C101) 06/23/89

Sen. Hatch
Senate Labor and Human Resources

DIGEST AS INTRODUCED:

Limited to provisions pertaining to EMS Comprehensive and Uniform Remedy for the Health Care System Act of 1989—Title V: Improving the Trauma Care System—Subtitle A: General Federal Emergency Medical Services Programs—Amends the Public Health Service Act to create a new title on emergency medical services. Directs the Secretary of Health and Human Services, by contract, to provide for the establishment and operation of a National Clearinghouse on Emergency Medical Services and Trauma Care. Sets forth the duties of the Clearinghouse. Allows the Clearinghouse to charge fees to defray and, starting with FY 1991, to cover its costs of operating. Authorizes appropriations for FY 1990 through 1992 or for the first through the third fiscal year after FY 1990 for which funds are appropriated under these provisions.

Directs the Secretary to promulgate regulations that require States that receive grants under provisions added by this Act relating to emergency medical services block grants to provide the Secretary with certain data and information concerning the use of the grants.

Authorizes the Secretary to make grants for research and demonstration projects concerning ways to improve the availability and quality of prehospital emergency medical services in rural areas by: (1) developing innovative uses of communications technologies; (2) making continuing education more accessible to emergency medical services personnel; (3) developing and refining training curricula; (4) undertaking outcome studies; and (5) developing innovative financing mechanisms. Authorizes appropriations for FY 1990 through 1992.

Requires the Federal Communications Commission, within one year of enactment of this Act, to: (1) complete a study of the availability of radio channels for emergency medical services; (2) establish a plan to ensure that the needs of such services shall be adequately provided for in the allocation of frequencies; and (3) submit a report containing the study and the plan to the appropriate Committees of the Congress.

Subtitle B: Emergency Medical Services Block Grant—Amends the Public Health Service Act to authorize appropriations for allotments to States for FY 1990 through 1992. Directs the Secretary, for each such fiscal year, to: (1) allot to each State an amount under a specified formula related to the population and land area of the State; and (2) make payments to each State. Prohibits the Secretary from making payments unless the State identifies any rural area for which there is no: (1) emergency medical services access through a 911 telephone number; (2) basic life-support system; or (3) advanced life-support system.

Sets forth application requirements.

Requires that amounts paid to a State under the allotments be used for: (1) accident prevention programs; (2) feasibility studies and planning activities for emergency medical services systems; (3) emergency medical services; (4) uncompensated trauma care as specified in this Act; and (5) other activities as determined by the Secretary.

Allows a State that receives a grant under the allotment to use not more than 25 percent of the grant to pay the expenses of certain uncompensated trauma care that has been provided.

Allows a State to use a limited amount to carry out emergency medical services activities under these provisions.

Removes provisions of the Public Health Service Act which allow States to use block grant allotment sums for feasibility studies and planning for emergency medical services systems and the establishment, expansion, and improvement of such systems.

H.R.911—Volunteer Protection Act of 1989 (C101) 02/07/89

Rep. Porter (Cosp=200)

DIGEST AS INTRODUCED:

Volunteer Protection Act of 1989—Prescribes circumstances under which volunteers working for nonprofit organizations or government entities shall be immune from personal financial liability for acts on behalf of the organization or entity. Sets forth exceptions to and conditions on the granting of such immunity that a State may impose. Requires the Secretary of Health and Human Services to increase by one percent the fiscal year allotment which would otherwise be made to a State to

carry out the Social Services Block Grant Program under Title XX of the Social Security Act if such State has, within two years, certified to the Secretary that it has enacted a State law which provides such immunity. Provides for the continuation of such increase based on an annual recertification.

H.R.950—National Rural Health Care Act of 1989 (C101) 02/09/89

Rep. Roybal (Cosp=30)

DIGEST AS INTRODUCED:

Limited to provisions pertaining to EMS—Amends the Public Health Service Act to authorize the Secretary to make grants to States which have submitted fiscal year plans for comprehensive State rural health access planning to assist States in such planning. Authorizes appropriations for such grant program through FY 1992. Requires each State to submit a comprehensive rural emergency medical services plan to the Secretary for each fiscal year, beginning with FY 1990. Authorizes appropriations through FY 1992 for payments to States, which vary among States on the basis of the proportion of the nation's rural population which reside in each State, to cover the costs of planning, implementing, and monitoring the operation of trauma care systems in rural areas.

Authorizes the Secretary to make grants to public and nonprofit entities for planning, constructing, equipping, supplying, and operating a rural health clinic and training the personnel at such clinic. Authorizes the Secretary to make grants to solo and small group medical practices which provide primary health services to medically underserved rural populations to assist such practices in purchasing equipment and supplies and training personnel. Sets forth grant conditions, including the requirement that such clinics and practices accept as patients Medicare and Medicaid recipients residing in their service area, and provide 24-hour-a-day emergency medical services.

Authorizes appropriations through FY 1992.

H.R.1587—Rural Emergency Medical Services Improvement Act of 1989 (C101) 03/23/89

Rep. Cooper (Cosp=51)
House Energy and Commerce

DIGEST AS INTRODUCED:

Rural Emergency Medical Services Improvement Act of 1989—Amends the Public Health Service Act to create a new title on emergency medical services for rural areas. Directs the Secretary of Health and Human Services to make an allotment for each State each fiscal year for improving the availability and quality, in rural areas, of emergency medical services and emergency medical services systems provided to victims of emergencies prior to the arrival of the victims at medical facilities. Requires, after FY 1990, non-Federal matching contributions in a specified ratio.

Allows a State to expend payments received for: (1) recruitment, training, and retention of personnel; (2) purchase, upgrading, and maintenance of equipment; (3) planning, coordination, and support of local emergency medical services and systems; and (4) public education.

Requires that the State plan for emergency services provide for adequate services in rural areas. Sets forth a formula for determination of the amount of allotments. Authorizes appropriations for FY 1990 through 1992. Authorizes the Secretary to make grants for research into and demonstration projects concerning ways to improve the availability and quality of prehospital emergency medical services in rural areas by using communications technologies, making continuing education more accessible, improving curricula, undertaking outcome studies, and developing innovative financing mechanisms.

Authorizes the Secretary to make grants for pilot projects to develop community-based centers to coordinate and deliver comprehensive occupational health and safety services to rural communities.

Authorizes appropriations for FY 1990 through 1992 for improving rural prehospital emergency services and for centers for rural occupational health and safety services.

H.R.1586—A Bill To Require a Study on Medicare Reimbursement for Ambulance Services (C101) 03/23/89

Rep. Cooper (Cosp=48)

DIGEST AS INTRODUCED:

Directs the Secretary of Health and Human Services to conduct a study into the adequacy and appropriateness of Medicare (Title XVIII of the Social Security Act) payments for ambulance services and report the results of such study to the Congress within one year of this Act's enactment.

H.R.1602—Trauma Care Systems Planning and Development Act of 1989 (C101) 03/23/89

Rep. Bates (Cosp=37)
House Energy and Commerce

DIGEST AS INTRODUCED:

Trauma Care Systems Planning and Development Act of 1989—Amends the Public Health Service Act to create a new title on trauma care.

Authorizes the Secretary of Health and Human Services to make grants and enter into cooperative agreements and contracts with respect to trauma care to: (1) conduct and support research, training, evaluations, and demonstration projects; (2) foster development of trauma care systems; (3) collect and disseminate information; (4) provide technical assistance to State and local agencies; and (5) sponsor workshops and conferences.

Directs the Secretary to establish the Advisory Council on Trauma Care Systems. Declares that, notwithstanding provisions of the Federal Advisory Committee Act, the Council shall continue in existence until otherwise provided by law.

Directs the Secretary to make an allotment for each State for each fiscal year for developing, implementing, and monitoring the modifications to the trauma-care component of the State plan for the provision of emergency medical services. Requires non-Federal matching contributions (in cash or in kind) in specified ratios for fiscal years after the first fiscal year of payments. States that such component of the State plan will be modified with regard to: (1) trauma care regions, centers, and systems; (2) triage and transport of children; (3) accreditation and evaluation; (4) data reporting and analysis systems; (5) procedures for paramedical personnel to assess the severity of injuries; (6) transportation and transfer policies; (7) public education; (8) coordination and cooperation; and (9) other matters.

Requires States to adopt guidelines for the designation of trauma centers, and for triage, transfer, and transportation policies, equivalent to the applicable guidelines developed by the American College of Surgeons and by the American College of Emergency Physicians. Authorizes the Secretary, after public notice and an opportunity for comment, to waive the requirement of adoption of such guidelines.

Mandates that States: (1) require each trauma center to provide certain information to the State emergency medical system annually; (2) submit to the Secretary, at least annually, the information it receives from its data reporting and analysis system; and (3) identify and submit to the Secretary a list of rural areas lacking certain emergency medical services.

Sets forth restrictions on the use of State allotments. Requires an annual report from each State to the Secretary. Sets forth a formula for determination of the amount of allotments. Provides for: (1) repayment and offset for failure to use funds as agreed; (2) criminal penalties for certain false statements; (3) technical assistance and provision of supplies and services by the Secretary in lieu of grant funds; and (4) a report by the Secretary to the Congress.

Authorizes appropriations for FY 1990 through 1992.

Directs the Secretary of Health and Human Services to conduct studies to: (1) identify programs established by States in order to reimburse trauma care centers and other health care providers for the uncompensated provision of health care; and (2) determine the adequacy and appropriateness of the reimbursements provided to trauma centers and ambulance service providers under Title XIX (Medicaid) of the Social Security Act.

SOURCE: Congressional Research Service, Bill Digest Files, SCORPIO, October 1989.

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